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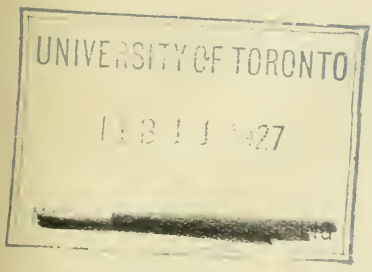

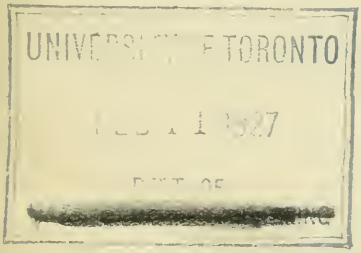

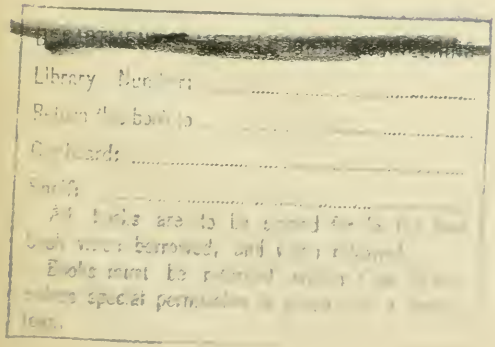

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Bulletin of the

American Ceramic Society

A Monthly Publication Devoted to Proceedings of the Society, Discussions of Plant Problems, Discussions of Technical and Scientific Questions and Promotion of Coöperative Research

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Volume 1, 1922

Edited by the Secretary of the Society, Ross C. Purdy
Assistant Editor, Emily C. Van Schoick
Assisted by Officers of the Industrial Divisions

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J. C. Hostetter, A. E. Williams } Glass

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J. S. McDowell, F. A. Harvey } Refractories

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Vol. 1 May, 1922 No. 1

FRANK H. RIDDLE

President of the American Ceramic Society

Mr. Riddle was elected president of the American Ceramic Society by letter ballot without opposition. For those members who have not had the privilege of meeting him or learning of his record as a ceramist his likeness is here shown and a sketch given.

President Riddle finished his Ceramic Engineering course at Ohio State University in 1907 and since that time has had a broad experience in the manufacture of art pottery, wall tile, porcelain and heavy clay products. He is now consulting engineer and chief ceramist of the Champion Porcelain Company of Detroit and the Jeffery-Dewitt Insulator Company of Kenova, West Virginia.

For two years prior to the war and during the war, Mr. Riddle was a member of the technical staff of the Bureau of Standards. It was he who developed the spark plug used in aeroplanes. The spark plugs made prior to that time would not stand the high temperatures and were a source of disastrous breakdowns. Mr. Albert V. Bleininger, then Director of the Clay Products Division of the Bureau of Standards, assigned Mr. Riddle to this problem and with him made investigations of the compositions and methods of manufacturing that resulted in the spark plug of exceedingly low coefficient of expansion and of very high hot dielectric strength. It was in this study that Mr. Riddle showed best his ability as a ceramic engineer.

FRANK H. RIDDLE

Mr. Riddle has designed, built and managed plants and has installed efficiency methods. His experience as a ceramist and as an executive has been broad. With the support which the ceramic craft has shown willingness to give to an aggressive program of coöperative research and with the leadership of one with so broad and so successful an experience as Mr. Riddle there is every reason for the 1922 record of the Society being the best ever in services rendered to the Ceramic Industries.

WHY IT IS IMPORTANT THAT CORPORATIONS SUPPORT THE AMERICAN CERAMIC SOCIETY

Corporations Have Learned Value of the Society to Them

The American Ceramic Society for these past twenty-three years has been building strong and surely as an organization for the promotion of ceramic researches. When it was first launched it was not possible to interest more than thirty-five manufacturers in its support. They were fearful of disclosing their so-called "manufacturing secrets," and had no appreciation whatsoever of the benefits of coöperation. These thirty-five manufacturers, however, did meet and soon found themselves exchanging bits of information and experiences, and even exchanging written notes concerning formulae, equipment and methods. They became so enthusiastic over the benefits of thus meeting together once a year and of having their discussions printed in "Annual Transactions," that they invited others to join with them. Today there are over 1600 joined in this coöperative enterprise, each gaining from the reported experiences of others.

Low Personal Subscription

Through all of these years, the Board of Trustees of the Society has been determined to keep the personal subscription at a very low figure. The personal subscription is now $7.50. The Board of Trustees has felt, and does now feel, that it is very essential that the personal subscription shall be kept low, so that the young men in the factories and the young men just leaving college and entering into the industry may enjoy the full privileges of the Society without undue tax on their incomes.

Monetary Value to Corporations

The monetary values of benefits accruing from activities of the American Ceramic Society are much larger and more direct to the corporations than they are to the persons. No corporation would hesitate to pay $25.00 for a bit of information which it thought would be a benefit in either reducing cost or improving product. Many corporations are paying out many times this amount for very much less than they are obtaining from the publications of, and from personal contact in, the American

Ceramic Society. When it is considered that the American Ceramic Society really is an organized research personnel, producing information based on actual laboratory determination and plant application, giving reports of proven facts of value to the manufacturer, the corporations should have no hesitancy in supporting the larger activities in which the Society is now engaged by subscribing to a corporation membership, dues, of which are $25.00 a year.

Larger Activities of the Society

These larger activities consist altogether in the more thorough organization of the Industrial Divisions and the activities of the Standing Committees, directing their efforts to definite ends, not only in researches themselves, but also in application of the result of researches. In the early days, and more so of late, the publications of the Society have perforce of circumstances been confined more to reports of researches in the fundamentals or scientific and have had to forego the development of personal discussions on the floor of the Conventions and in their publications. The Society has not had the funds to develop the application of the results of these fundamental studies in ceramic science nor given opportunity of exchange of opinion and experiences through discussions.

Estimated Budget

It is estimated that the Society can enter into, to a very full extent, all of these activities, on a budget not exceeding $40,000 per year. $15,000 of this $40,000 will be realized from the advertising in the *Journal* and *Bulletin*, and the larger part of the remaining $25,000 must be obtained from membership dues. The Society has never made an assessment and it will be the policy of the Board of Trustees that an assessment shall not be levied. It would be defeating the purposes of the Society to raise the personal dues, and therefore it is but natural that the corporations will be asked to pay the small subscription of $25.00 a year in support of this organized promotion of research. They have received, and will continue to receive, the largest monetary benefit, and therefore should be providing for the larger part of the funds that are necessary to sustain the activities of the Society.

This is a statement of facts, not a plaintive appeal.

The Board of Trustees has no fear but that corporations will see the benefits of a virile organization devoted exclusively to the promotion of technical and scientific things in ceramics. They already realize the importance of this in trade matters and they have shown their appreciation of the necessity for organized technical research.

PERSONAL VERSUS CORPORATION MEMBERS IN THE AMERICAN CERAMIC SOCIETY

The paying of personal dues by corporations has developed the question of personal *versus* corporation dues, because the purpose of each of these classifications is not clear with the members. We have had corporations resign as such when their representatives learned that they could have the rights and benefits of membership for $7.50 a year. Therefore, they argue, why pay $25.00? Other corporations have told their men that their personal subscriptions were to be cancelled since the firm had subscribed as a corporation member. In all but very few such instances we have succeeded in so stating the importance of both personal and corporation memberships that the Society has not been the loser.

We are not questioning the policy of corporations paying personal memberships of employees. In some instances there is advantage in this to all concerned, and certainly no disadvantage to the Society.

Value of Personal Memberships

The Society an Educational Institution.—To the individual, the Society is an educational institution, an opportunity to increase knowledge, acquaintance and outlook, not alone in a particular industry, but in all of the ceramic industries. An investigator or plant operator cannot afford to be without the literature, the forum, the opportunities of co-operation, the broadening knowledge of problems and of their solution in all ceramic lines.

The Society Broadens Intellectual Opportunities of Members.—To be without the opportunities of membership in the American Ceramic Society would be limiting one's sphere of knowledge and acquaintance and certainly one's opportunities. The most successful members of university faculties refuse industrial connections because they value the opportunity to engage in research and to publish their results without restrictions. Technical societies give this same sort of opportunity to men in the industry of "letting their light so shine before men that their good work shall be known."

The Employee's Value to Employer Increased by Activities of the Society.—A person is given an industrial position and a salary because of what, and in proportion to what, he knows and can do. Keeping abreast of the times is just as important a factor in one's value to a firm as preparation before entering industry. Indeed, he becomes of less and less value to a concern unless he not only keeps abreast with new discoveries, etc., but also makes his contribution to the new knowledge of materials, processes, equipment, and especially of the application to industry of scientific fundamentals.

Technical societies give opportunities for a person to receive from many

co-workers in return for that which he contributes. Thus his knowledge and facilities are manifolded. It is foolish to think that these manifolded returns come in any such proportions to those who attend conventions only for what they can learn, as to those who do things and give to others of their knowledge and experience.

Summing up the advantages of membership to individuals, it can be said in truth that the Society is necessary to the individual if he is to continue his present value or is to increase his value to the concern which gives him employment. A person in the ceramic industry cannot afford to be without a personal membership in the Society.

Value of Corporation Membership

The Value of Research Is Recognized.—The returns from the activities of the Society to corporations are almost directly financial. The importance and value of research to industries is well known. The millions given in support of researches by individuals, and corporations, not alone in industrial but also in public and semi-public laboratories speak with far more force than words concerning the importance of research to manufacturers. The inestimable value to industries of researches done and published by the Federal Bureaus, the Geophysical Laboratory and the several industrial laboratories is well known. There is no longer a reason for anyone to doubt the value of research. The National Research Council is a magnificent monument to the belief of successful manufacturers in the necessity of research in industry.

The Value in Personal Contact and Discussions.—That the results of these researches may be applied with greatest profit to the industries, it is essential that the technical men and the plant operators get together to discuss these results from the view-point of conditions in the individual plants. There is value accruing to the corporations when their technical men and their plant operators get together to tell of experiences in plant application of the results of researches.

The Importance of Researches Made in Plants.—A great deal of research work is done right in the plants; research that cannot be carried through in laboratories. Such researches are essential to the productiveness of the laboratories. It is just as important for the laboratory investigators to keep posted on the researches made in the factories, as it is for the factory investigators to keep posted on the researches made in the laboratories. This means direct returns to the manufacturers.

It is only in technical societies that the laboratory and the factory investigators can get together to discuss, analyze and make plans for further work.

The Value in Corporations Exchanging Research Information.—The technical societies give opportunity for each concern to receive from

all the other contributing concerns in exchange for the information they give. This is a manifolding of returns on investments made in research that should make it plain to every manufacturing concern that it pays to give financial support to technical societies. It is especially vital that the ceramic manufacturers give support to this, the only Society devoted exclusively to the promotion of Ceramic Arts and Sciences.

The Value of the Society to Corporations Is Direct.—The returns enjoyed by corporations from the activities of the American Ceramic Society are directly financial, and these returns will be in proportion to the support given.

If the total annual subscription of a corporation was $100 it would be an inadequate measure of the value which the Society has been and can be to each corporation. It matters not how many personal subscriptions a firm pays for its employees it will not be giving support to the Society in proportion to the direct returns enjoyed. The returns to corporations will be in proportion to the number of individuals who make contact with the activities of the Society, hence it behooves a concern to make these contacts through as many of their personnel as is possible, but it is also to their interest to give financial support to the Society that these personal contacts of their employees may be the more productive.

The corporation annual fee of $25.00 is small in comparison with the usual fees, yet it is adequate to meet the budget of the Society, when each of the ceramic corporations will be doing its share.

Fellow Member!—Is your firm making your membership of more value to it through an annual corporation subscription? Does this suggest a duty you owe to yourself, to your firm, and the Society?

AMERICAN CERAMIC SOCIETY EXCURSION TO ENGLAND AND EUROPE

A year ago members of the Society received a communication from Mr. C. O. Grafton inquiring who would be interested in being one of the party to visit England in 1922 in response to the invitation of the British Society of Glass Technology. Several hundred replies to that inquiry were received and in consequence, negotiations with the English Society were commenced with regard to the reception of those of our Society who are interested in things other than Glass. Dr. Turner writes that the Refractories group surely will be welcome. Definite assurance regarding the other groups has not been received but the negotiations are still in progress and the indications are favorable in the case of the White Ware group, and there have been no definitely unfavorable reports.

Accordingly reservations have been made on the Cunard Line Aquitania sailing from New York on August 22, 1922, for the accommoda-

tion of about 40 persons. The rate is $275.00 plus tax ($5.00) per passenger, from New York to Southampton. Furthermore the Cunard Line has given assurance that every effort will be made to insure a comfortable and enjoyable trip. A small group of about ten have already "signed up," but unless a party of at least twenty-five is secured the reservations must be cancelled and the trip postponed. These reservations must be taken up or cancelled before June 29th and so decisions must be made not later than June 1st. Of course an early reply will be necessary from those intending to make the trip. In such a case, deck plans of the Aquitania will be sent so that cabins may be selected. Dr. Turner has in charge the arranging of the tour of England, which will require about three weeks. Special trips will be arranged for the several groups representing the Divisions of our Society. Those wishing to visit the continent will be expected to make their own arrangements since no organized visit will be made. Dr. Endell has assured us of a welcome in Germany and Dr. Turner will assist in arranging tours to the Continent.

The steamship agency in Pittsburgh through which these reservations have been made has offered numerous courtesies regarding the securing of passports, the insurance of baggage and the securing of hotel accommodations in New York for the party for the day or two before sailing. The details of these arrangements will be communicated later to those who are planning to join the party.

Those interested will please notify Dr. E. Ward Tillotson of Mellon Institute, Pittsburgh, Pa., as early as possible.

THE NEED FOR ORGANIZATION IN SCIENTIFIC RESEARCH[1]

By Elihu Root

Chairman of the Board of Trustees, Carnegie Institution of Washington

Extracted from Vol. 1, Part 1, No. 1, Oct., 1919, *Bulletin of the National Research Council.*

I have no justification for expressing views about scientific and industrial research except the sympathetic interest of an observer for many years at rather close range. One looking on comes to realize two things. One is the conquest of practical life by science: there seems to be no department of human activity in which the rule of thumb man has not come to realize that science which he formerly despised is useful beyond the scope of his own individual experience. The other is that science, like charity, should begin at home, and has done so very imperfectly.

Science has been arranging, classifying, methodizing, simplifying everything except itself. It has made possible the tremendous modern development of the power of organization which has so multiplied the effective power of human effort as to make the differences from the past

[1] Washington, D. C., August, 1918.

seem to be of kind rather than of degree. It has organized itself very imperfectly. Scientific men are only recently realizing that the principles which apply to success on a large scale in transportation and manufacture and general staff work apply to them; that the difference between a mob and an army does not depend upon occupation or purpose but upon human nature; that the effective power of a great number of scientific men may be increased by organization just as the effective power of a great number of laborers may be increased by military discipline.

This attitude follows naturally from the demand of true scientific work for individual concentration and isolation. The sequence, however, is not necessary or laudable. Your isolated and concentrated scientist must know what has gone before, or he will waste his life in doing what has already been done, or in repeating past failures. He must know something about what his contemporaries are trying to do, or he will waste his life in duplicating effort. The history of science is so vast and contemporary effort is so active that if he undertakes to acquire this knowledge by himself alone his life is largely wasted in doing that; his initiative and creative power are gone before he is ready to use them. Occasionally a man appears who has the instinct to reject the negligible. A very great mind goes directly to the decisive fact, the determining symptom, and can afford not to burden itself with a great mass of unimportant facts; but there are few such minds even among those capable of real scientific work. All other minds need to be guided away from the useless and toward the useful. That can be done only by the application of scientific method to science itself through the purely scientific process of organizing effort.

This relation of the scientific worker to scientific work as a whole can be furnished only by organization. All the world realizes now the immense value of the German system of research applied at Charlottenburg and Grosslichterfelde. That realization is plainly giving a tremendous impetus to movements for effective organization of scientific power both in England and in the United States—countries whose whole developments have rested upon individual enterprises. It remains to be seen whether peoples thoroughly imbued with the ideas and accustomed to the traditions of separate private initiative are capable of organizing scientific research for practical ends as effectively as an autocratic government giving direction to a docile and submissive people. I have no doubt about it myself, and I think the process has been well begun in England under the Advisory Council of the Committee of the Privy Council for Scientific and Industrial Research, and in the United States under the National Research Council.

I venture to say two things about it. One is that the work cannot be done by men who make it an incident to other occupations. It can be encouraged of course by men who are doing other things, but the real

work of *organization* of research must be done by men who make it the whole business of their lives. It cannot be successful if parcelled out among a lot of universities and colleges to be done by teachers however eminent and students however zealous in their leisure hours. The other thing is that while the solution of specific industrial problems and the attainment of specific industrial objects will be of immense value, the whole system will dry up and fail unless research in pure science be included within its scope. That is the source and the chief source of the vision which incidentally solves practical problems.

AMERICAN CERAMIC SOCIETY EXHIBITION

The First American Ceramic Society Ceramic Display

By Frederick H. Rhead

For the first time in the history of the American Ceramic Society, an exhibition of the various ceramic products was held during the twenty-fourth annual convention. While there was little time in which to plan this exhibit, the response from manufacturers, educational institutions, and studio potters was very satisfactory, and every Division was represented.

The display was not only well attended, but the members were much interested in the exhibits, as was evidenced by the many interesting discussions relating to the various types of ceramic wares shown. The following classification will give a fair idea of the scope of the activities represented.

Art Division

Schools

The New York State School of Clayworking, under Profs. Marion L. Fosdick and Clara K. Nelson; Prof. C. F. Binns, Director. Included in the group executed by the students of this school were some very charming, and well-finished turquoise vases and bowls.

The Department of Ceramics of Iowa State College, Ames, Iowa, under the direction of Paul C. Cox. This exhibit was particularly interesting because it gave a good idea of the scope of work covered by this school. It is very evident that there is a serious attempt to develop the resources of the state. Different types of clay were used. In this exhibit were examples of art wares, stoneware utilitarian vessels, casseroles, etc., buttons made of red clay, an incense burner, and a small enameled metal bowl.

The Newcomb School of Art, Mary G. Sheerer, Instructor, sent a most dainty group of bowls, tea caddies, and vases made with a light-colored clay and glazed with soft green, and other colored enamels. These pieces were very nicely finished and gave ample evidence of great care, and considerable skill.

The Lewis Institute, Chicago, Illinois, under the direction of W. W. Wilkins, had a group of hand built pottery finished in matte and enamel

FIG. 1.—View of Art Exhibit. Rookwood Pottery in large case at left. Fulper Pottery in far corner. Vases by Prof. C. F. Binns at right. Overbeck Pottery on table in center.

FIG. 2.—Art Exhibit. Newcomb College and Lewis Institute Pottery on center table. S. A. Weller Pottery, left corner. Paul Revere Pottery, right corner.

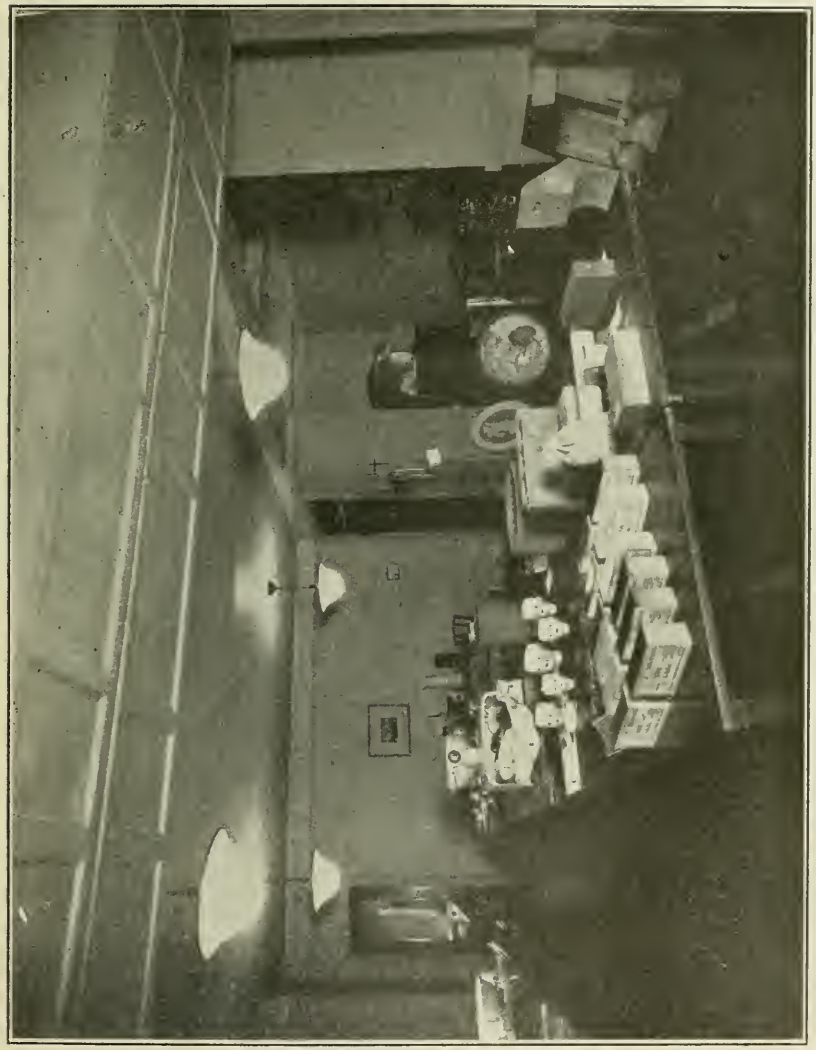

FIG. 3.—Refractories and Terra Cotta Exhibit.

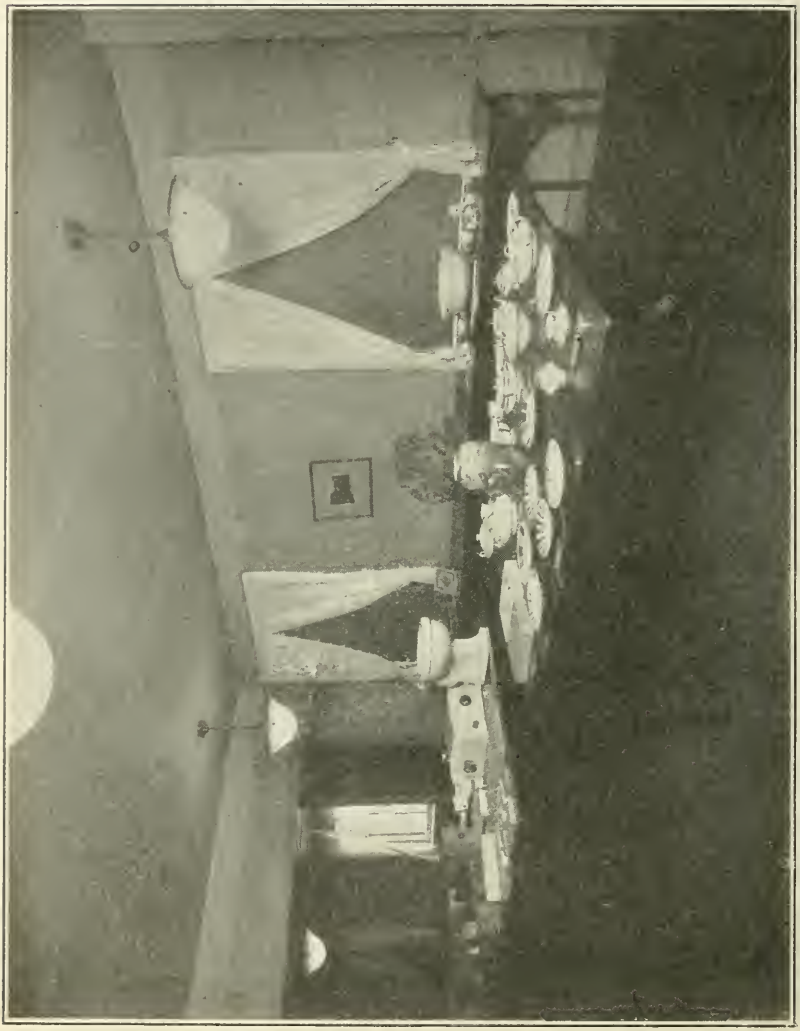

FIG. 4.—White Ware Exhibit.

glazes, and also a series of glaze experiments. In connection with the latter, it is hoped that other schools will follow this example and exhibit experimental work.

The St. Louis Grade Schools sent a small group of hand built vases and flower holders.

Miss Mabel C. Farren, formerly instructor in pottery in the Carnegie Institute of Technology, Pittsburgh, exhibited a series of photographs of pottery made by the students under her direction.

Art Potteries

The Rookwood Pottery exhibited a beautiful group of vases showing various developments during the later years of their activity. In this group were examples of their famous "Tiger Eye" glaze, their exquisitely executed slip decorations, and a very handsome rose jar of Chinese type.

Fulper Pottery was represented by a group of vases in stoneware, or Grès, finished in mirror black, matte and enamel glazes.

Newcomb College, New Orleans, sent a group of vases and bowls finished in nicely balanced harmonies of greens and blues. Newcomb Pottery, with its well-designed woodland decorations, is one of the few distinctive American Potteries.

Other potteries exhibiting were The Paul Revere Pottery, Boston, Mass., showing examples of their well-known nursery utilitarian ware, and S. A. Weller of Zanesville, Ohio, who sent a wide range of ornamental pottery, including lustres, matte glazes, enamels, modeled birds, etc.

Studio and Individual Potters

The most noticeable impression received by the follower of the Arts and Crafts movement when viewing such a ceramic exhibition as the one under discussion is of realization that the American potter is surely and definitely becoming master of his craft.

Both in the schools and in the small studio potteries, the technique and execution has developed to a standard far ahead of that of the studio clayworker of ten, or even five years ago. In fact, the craft has already advanced to a stage where it is possible to name from a dozen to twenty schools and individual potters who can show the products of their kilns side by side with the work of European potters of high reputation without suffering in comparison.

The credit for this development naturally belongs to the schools; and, because these schools are giving due attention to such important factors as workmanship, execution, technique, or all those conditions that contribute to what is good in potting, the various manufacturers, and others who are actively interested in the higher development of the industry, can not do better than to use every available means to encourage and support the schools in the work they are doing.

List of exhibits of individual potters: Professor C. F. Binns, Director of the New York State School of Clayworking, had a case of very beautiful stoneware vases and bowls. One piece, a gourd or bottle-shaped vase, is fine enough to find a place in any museum among a collection of American contemporary art.

Arthur E. Baggs, Marblehead, Mass., had two most attractive and skilfully executed jardinières. Russell G. Crook, South Lincoln, Mass., sent two stoneware vases with cleverly designed animal motifs. Mrs. Frederick H. Rhead sent a series of porcelain panels with Pate-sur-pate figure decorations; the Misses Overbeck, Cambridge City, Indiana, exhibited a variety of shapes very prettily decorated and executed. Miss Mabel C. Farren, Pittsburgh, Pa., sent a series of earthenware and porcelain dinner plates decorated with liquid underglaze colors. Bertha Riblet Pire, Cleveland, Ohio, sent some very attractive tile. Mr. B. S. Radcliff and Mr. L. A. Behrendt, St. Louis, had a pair of chrome-tin pink enamels, and Mrs. Mary Chase Stratton of the Pewabic Pottery, Detroit, sent a group of tile and vases finished in enamels and lustre, all most charming in color and texture.

A case of cabinet pieces, showing examples of Sung, K' ang-shi, Chenlung, and also some Japanese porcelains of the old school, from the collection of F. H. Rhead were used for reference purposes during various process discussions.

Glass Division

The Glass Division was represented by H. C. Fry Company, of Rochester, N. Y., with examples of cut glass, baking wares and some very attractive utilitarian articles.

White Ware Division

This Division was represented by the Knowles, Taylor and Knowles Co., East Liverpool, Ohio, Hercules China Co., Sebring Pottery Co., Sebring, Ohio, Homer Laughlin China Co., Newell, W. Va., Edwin Knowles Co., East Liverpool, Ohio. The Universal Sanitary Manufacturing Company of Newcastle, Pa., sent three examples of their cast sanitary ware. One of these pieces was in cross section showing the even thickness all through the piece when made by the cast process. The Coors Porcelain Co., of Golden, Colorado, had a comprehensive exhibit of chemical porcelain. The General Electric Company, Schenectady, N. Y., The Lapp Insulator Co., LeRoy, N. Y., and the Jeffery-DeWitt Insulator Company, Kenova, W. Va., exhibited examples of various types of porcelain insulators.

A series of plates showing various ceramic colors was shown by the Roessler-Hasslacher Company, New York. The examples of porcelain doll heads made by the Fulper Pottery Company, Flemington, N. J., should also be included in the white ware group.

Terra Cotta Division

FAIENCE AND TERRA COTTA WARES

The following concerns sent examples of architectural faience and terra cotta: The Northwestern Terra Cotta Company, Chicago, Ill.; O. W. Ketcham Terra Cotta Company, Crum Lynn, Pa.; American Terra Cotta Company, Chicago, Ill.; St. Louis Terra Cotta Company, St. Louis, Mo.; The Conkling Armstrong Company, Philadelphia, Pa.; The Rookwood Pottery Company, Cincinnati, Ohio; and The Flint Faience Tile Company, Flint, Mich.

Conrad Dressler sent a series of photographs of bas-relief panels, a bust in terra cotta of Philip Dressler, and a very beautiful sketch medallion finished in blue and green transparent glazes.

Refractories

The Refractory Division was represented by The Norton Company, Worcester, Mass.; The Carborundum Company, Perth Amboy, New Jersey; The Mitchell Clay Manufacturing Company, St. Louis, Mo.; and the Laclede-Christy Clay Products Company, St. Louis, Mo.

Stoneware

The Maurice Knight Company of Akron, Ohio, sent a number of examples of acid-proof chemical stoneware.

PROPHETIC COST ACCOUNTING

By G. W. Greenwood

The ultimate aim of the American Ceramic Society is to increase human happiness. With building materials of clay, man possesses a more beautiful and a more comfortable home; by pottery and other objects of ceramic art it is furnished and made more attractive; a brick road leads to it; by tile, his land is drained, and refractories play their part in the production of everything in the manufacture of which fire has been employed.

This Society affords each member an opportunity of understanding better the part performed by others in this pursuit of the common welfare, and, by their sympathetic coöperation, its members help one another.

The importance of this harmonizing and illuminating influence, as here exhibited, becomes more fully realized when one sees the indifference, even the antipathy, of men engaged in different phases of the same, or kindred, subjects, as in pure and applied science, research and practical operation.

Too often practical men, without whose services we would starve, are not in sympathy with research, without which we would have no progress. For instance, a practical man might ask the use of the chemistry of the

stars, yet helium, named for the place of its discovery, was first found on the sun, thus outdoing Baron Munchausen whose hatchet, altho found on the moon, had been previously lost on the earth. That the propagation of yellow fever is through the bill of a mosquito of a certain species, which a certain number of days before has bitten another victim, is a discovery which justifies all the time spent in studying the habits of insects. When Pasteur first contemplated the study of spontaneous generation, his friends attempted to dissuade him from wasting his time on that barren subject, and yet modern surgery is but one of the results. Kepler studied astronomy, giving the world the three laws which bear his name, laying the foundations upon which Sir Isaac Newton builded, but he practiced astrology on the side to pay expenses. The Curies, when they started out to track radium to its lair, little suspected, as we indeed little suspect now, the future possible applications of this element. Research is like the leaden casket which promises nothing but which pays the best.

On the other hand, however, men intent upon scientific pursuits too often care naught for the possible benefits therefrom: Gauss, the mathematician, thanked God for the theory of numbers, because it was a branch of mathematics which could not possibly be put to any practical use.

But while pure and applied investigators find here in this Society a meeting place, a common forum, there is yet one science for which neither faction has much, if any, respect. And that is Cost Accounting.

Practical men see in it no promise of profit, and the research investigator sees in it no promise of hidden truth. Both are sadly mistaken. The accountant is viewed as one who merely juggles figures, making different combinations, but unable to alter their total. For instance, the writer has been asked, "What difference does it make anyway? Whatever system is used, you have no more money in the bank."

And of ordinary, post mortem cost accounting, this may indeed be true, for instead of dealing with live problems, the accountant too often spends most of one month embalming and wrapping in red tape results which expired the last day of the previous month.

This is what I mean by post mortem accounting: About the twentieth of the month, the bookkeeper presents the management with a statement of the operating and other expenses for the previous month, each element being divided by the output (or by some other factor).

Instead of entering into a critical discussion of this process, since this is not a meeting of accountants, consider the following illustration: Suppose one were to take daily readings for a month of the temperature of all kilns under fire, add these temperatures, and divide by the total number of readings, presenting this average to the manager about the twentieth of the following month. Of what use would this average be in controlling current kiln temperatures? Or, suppose on going to the ticket agent for infor-

mation concerning trains to St. Louis, with a view to attending a meeting of the American Ceramic Society, the agent were to tell you that, instead of advance information as to the movement of trains, he had on file only the result of the movement of trains during the previous month: and that this result was found by taking the time of all trains between Pittsburgh and St. Louis, freight and passenger, express and local, and dividing the total time by the number of trains which started from Pittsburgh during the month. Of what use would this information be to you?

I can see no difference between these hypothetical cases and the actual case of a manager wishing to know the cost of certain fire clay shapes which he proposes to make the following week, but who is offered instead the result of taking the charges for the previous month and dividing by the nine-inch equivalent of all brick and shapes, hand made and machine, standard and special, easy and difficult, which were molded.

We are told, authoritatively, that considerably less than ten per cent of the country's industries have a cost system. But if we define cost finding as *the elimination of waste and the reduction of costs by means of modern accounting methods*, then the number having cost systems will shrink to an alarming extent.

The principles underlying scientific accounting are the same as those for any other science and they are already recognized, and employed, by this Society. Therefore this Society can give a decided impetus to actual, constructive cost accounting.

The first element in a successful system of accounting is *predetermination*. But here again, let us draw our illustrations from familiar sources. To the ancients, there existed seven heavenly bodies: the Sun, the Moon, Mercury, Venus, Mars, Jupiter, Saturn, a complete, a perfect number, known to man as far back as written records extend. That there might be another planet was beyond the scope of one's imagination. Then, by chance, using his home-made telescope, Herschel discovered a new planet which was named Uranus. Years later a mathematician sent an astronomer word to turn his telescope to a certain part of the heavens and to look for a new planet. And thus was Neptune found by calculation before it was seen. How? By the fact that the movement of Uranus was predicated, but that it did not conform to the path worked out for it.

The discovery of the telescope was soon followed by the discovery of four moons of Jupiter. Their eclipses were observed, and future eclipses predicted. But future eclipses failed to occur on schedule time. At one time they would be punctual, several months later they would be behind hand, then again they would conform to the forecast. From this discrepancy came the discovery of the velocity of light, which up to that time had been thought to be instantaneous. From this also is derived a relationship between light and electricity, and from it the Einstein theory has been

evolved. From a study of the properties of chemical elements, the existence of new, and as yet undiscovered, elements was successfully predicated and the properties foretold.

These illustrations could be multiplied. But the lesson they all teach is this: If one merely recorded the past, and did not forecast the future, what progress would there be? Aside from that which comes by accident, most progress results from prediction followed either by verification confirming our hypotheses to this extent, or by discrepancies which lead to investigation and new discoveries.

It is the business of science to *predict*. It is the business of a scientific cost system to *predict costs*, and then either to confirm the prediction or to investigate the discrepancies. *A cost system, to be profitable, must be prophetic.*

To you, of course, this presentation is not new. Prophecy is ingrained in your methods of operation. It is only the cost department which lives in the past. I trust that upon your return to your labors, you will say something like this to your accounting departments: "We lay out in advance, a running schedule. We plan to make a product of a specified size, shape, or color; to stand up under a certain fusion test, or under a specified rattler test. We plot before it is fired the curve to which the temperature of a kiln should conform. We make promises of future delivery of material. We have a definite time to start the day's work, and a standard turn per day. We know what each machine is supposed to turn out per hour. We have an hourly wage, and an established salary list. Everything possible is predicted, and performances are checked up against predictions. *We expect you to take this same course in your accounting.*"

ACTIVITIES OF THE SOCIETY

Annual Tables of Constants and Numerical Data

Physical, Chemical and Technological

The confederation of French scientific societies has renewed for the year 1922 its contribution of 40,000 francs in support of Annual Tables. The total subscription in France to this project during the year 1921 was 80,000 francs.

At the approaching meeting of the International Union of Pure and Applied Chemistry which is to be held at Lyons in June, the matter of organizing the work of Annual Tables upon a solid financial basis will come up for consideration. This important international project has had a very precarious existence since 1914 and the fact that the work has been continued at all has been due to the efforts of the General Secretary, Dr. Charles Marie.

Plans for providing a certain and sufficient budget for the work during the next five years are in preparation, based upon definite annual contributions from the various countries in the International Union.

It is announced that the National Research Council of Japan has appointed the following Advisory Committee for Annual Tables:

Yasuhiko Asahina	(Tokyo)	Seiji Nakamura	(Tokyo)
Eiji Aoyagi	(Kyoto)	Kyoji Suyehiro	(Tokyo)
Kotaro Honda	(Tohoku)	Umetaro Suzuki	(Tokyo)
Katsuji Inouye	(Tohoku)	Takuro Tamaru	(Tokyo)
Gen-itsu Kita	(Kyoto)	Mitsumaru Tsujimoto	(Tokyo)
Koichi Matsubara	(Tokyo)	Nobuji Yamaga	(Tokyo)
Tsuruzo Matsumura	(Kyoto)	Noboru Yamaguti	(Tokyo)

The Chairman of the Committee is Professor Yukichi Osaka, Japanese member of the International Commission in charge of Annual Tables.

The American Ceramic Society contributes to the support of this great coöperative enterprise.

Report of Annual Meeting of White Wares Division

It affords me great pleasure to inform you that the annual meeting of the White Wares Division was a great success, both from the standpoint of attendance and from the number and character of papers contributed.

At the business meeting, the by-laws recommended by the Rules Committee for use in the several divisions were adopted in their entirety.

The following officers were elected for the year 1922:

Chairman—Samuel B. Larkin,
National China Co., Salineville, Ohio.

Secretary—C. C. Treischel,
General Electric Co., Schenectady, N. Y.

Chairman Research Committee—F. K. Pence,
Knowles, Taylor & Knowles, East Liverpool, O.

Chairman Rules Committee—August Staudt,
Perth Amboy Tile Works, Perth Amboy, N. J.

Chairman Membership Committee—Ira E. Sproat,
Mahoning Clay Company, Sebring, O.

Chairman Nominating Committee—Mr. Herbert E. Goodwin,
Crescent China Co., Niles, O.

Chairman Standards Committee—H. Spurrier,
Square D Company, Peru, Ind.

The White Wares Division representative on the Coördinating Service Council will be as follows:

Committee on Research—F. K. Pence.

Committee on Standards:

(*a*) Standardization of Tests, F. S. Hunt.

(*b*) Standardization of Products, H. Spurrier.

Committee on Data—C. C. Treischel.

Out of a total of 22 listed papers and colloquiums, 18 were presented at the Divisional meeting.

The Division, by a unanimous vote, adopted a resolution to carry a coöperative investigation of the sagger problem, as affecting the White Wares Industry. This problem will, no doubt, be taken care of within the near future by the Research Committee.

CHESTER TREISCHEL, *Secretary*,
White Wares Division

Minutes of the Fourth Annual Meeting of the Glass Division of the American Ceramic Society

Hotel Statler, St. Louis, Mo., Feb. 28, 1922.

The meeting was called to order by Vice-President J. C. Hostetter, J. H. Forsyth acting as Secretary. The following papers were read:

The Passing of King Methane, S. R. Scholes (read by W. A. Yung).

Reports on Tentative Standards of Glass House Refractories and on Lime, A. Silverman (read by D. W. Ross).

A Note on the Effect on Manganese in Glass of Melting at Reduced Pressure, E. N. Bunting.

Operation of Leers, C. E. Frazier.

After adjournment for lunch the reading of papers was continued.

A Small Glass Tank, H. T. Bellamy.

The Handling, Storing and Setting of Glass Pots, Wm. M. Clark and J. H. Forsyth.

Physical Defects in Tank Blocks, G. A. Loomis.

Disintegrating Action of Water on Soda Lime Glass, A. E. Williams.

Evolution and Development of Glass House Equipment, J. S. Herzog.

The meeting was again called to order on Wednesday, March 1st at nine-thirty A.M.

This session commenced with a discussion of tentative specifications for Glass House Refractories. It was voted that "The Report of this Committee as such, be not accepted as tentative specifications for refractories and that it be referred back to the Committee on Standards and that said committee consult with a committee appointed from the Refractories Division and the two committees consult with committee C-8 of A. S. T. M."

After discussing the "Tentative Specifications for Lime in Glassmaking" it was voted *to adopt the specifications as tentative.*

The colloquium topics were then taken up and resulted in a lively and interesting discussion. Indeed the entire meeting was characterized by free and lively discussions.

The following officers were elected for the ensuing year.

Chairman	J. C. Hostetter
Vice-Chairman	A. R. Payne
Secretary	A. E. Williams
Councillors	H. W. Hess
	J. W. Wright

It was voted that the Chairman be given instructions and power to appoint all committees.

E. Ward Tillotson, *Secretary*

NEW MEMBERS RECEIVED SINCE FEBRUARY 20, 1922

Associate

Abbott, Harold W., St. Marys, Pa., Carbon Division, Stackpole Carbon Co.

Adams, C. C., Latrobe, Pa., Sec.-Treas., Conemaugh Iron Works Co.

Adams, Samuel P., 29 S. LaSalle St., Chicago, Ill., Ashland Fire Brick Co.

Adderley, James R., 50 Lower Potter St., Brierley Hill, S. Staffs., England, Chemist, E. J. & J. Pearson Ltd.

Aichele, Albert E., 524 Orchard Ave., Cambridge, Ohio.

Anderle, Emil J., 132 E. Hudson Ave., Dayton, Ohio, International Clay Machinery Co.

Beebe, Daniel S., Chamber of Commerce Bldg., Chicago, Ill., Vice-Pres., Treas. and Gen. Mgr., The Vitrolite Co.

Birner, William, Box 139, R. R. No. 1, East San Gabriel, Cal., Washington Iron Works.

Bittner, A. G., Central Sta., Box 1400, St. Louis, Mo., Factory Supt., National Enameling and Stamping Co.

Black, Percy C., Amherst, Nova Scotia, Pres., Nova Scotia Clay Works Ltd.

Breese, A. G. C., 344 N. Pearl St., Bridgeton, N. J., Furnace Foreman, Illinois Glass Co.

Burt, P. E., Box 1026, Huntington, W. Va., Saks Stamping Co.

Busch, Albert D., 5379 Pershing Ave., St. Louis, Mo., The W. S. Tyler Co.

Bussell, William T., Brazil, Ind., Plant Supt., The Clay Products Co.

Butterfield, Fred H., 4906 McPherson Ave., St. Louis, Mo., Plant Mgr., Crunden Martin Mfg. Co.

Caven, Trevor M., 26 Cortlandt St., New York City, Consulting Engineer, Quigley Furnace Specialties Co.

Conard, John B., 91 W. Third Ave., Mansfield, Ohio, Supt., Richland Shale and Brick Co.

Condit, Leo B., 23 N. Lotus Ave., Chicago, Ill.

Cossette, Louis J., 1821 Vernon St., N. W., Washington, D. C., U. S. Bureau of Standards

Craig, Robert H., 15607 Loomis Ave., Harvey, Ill., George M. Clark & Co.

Dandurand, Raymond A., Brazil, Ind., Sec., The Clay Products Co.

Dedouch, J. A., 611 S. Elmwood Ave., Oak Park, Ill., Mgr., Imperishable Miniatures Co.

Duty, S. M., 4900 Euclid Ave., Cleveland, Ohio, Pres. and Treas., The Medal Paving Brick Co.

Elsenius, Charles A., 1631 Woolsey St., Berkeley, Cal.

Ford, Karl L., 3555 Eleventh St., N. W., Washington, D. C., U. S. Bureau of Standards

Frank, G. Harry, 3328 Monroe St., Chicago, Ill., The Meyercord Co.

Geuder, George, 38 Fifteenth St., Milwaukee, Wis.

Hazelwood, Fred, 310 R St., N. E., Washington, D. C.

Heinz, George P., 1740 Champa St., Denver, Colo., The Heinz Roofing Tile Co.

Herzog, John S., Newark, Ohio, Gen. Mgr., The Simpson Foundry and Engineering Co.

Holbert, John S., 7349 N. Paulina St., Chicago, Ill., Dist. Mgr., Hardinge Co.

Hollowell, R. D. T., 110 S. Dearborn St., Chicago, Ill., Sec., American Face Brick Association.

Holman, Harry B., 1017 Olive St., St. Louis, Mo., Mgr., Industrial Division, Commercial Dept., Laclede Gas Light Co.

Ivery, Sidney H., 4432 Gibson Ave., St. Louis, Mo., Enamel Plant Supt., Hydraulic Press Brick Co.

Jeffery, L. Edson, Detroit, Mich., Champion Porcelain Co.

Johnson, Joseph, Trenton, N. J., Chemist, Research Division, Trenton Potteries Co.

Jones, John E., 28 Vine St., Trenton, N. J., Trenton Potteries Co.

Jones, Walter A., 50 Third St., Columbus, Ohio, Pres., W. R. Jones & Co.

Kahn, Bertrand B., Hamilton, Ohio, Sec. and Gen. Works Mgr., Estate Stove Co.

Kneisel, Carl F., Box 732, Sheridan, Wyo., Sec.-Treas. and Mgr., Sheridan Press Brick and Tile Co.

Lasley, Marshall, 801 Volunteer Bldg., Chattanooga, Tenn., Vice-Pres., Southern Clay Mfg. Co.

Lawrence, George J., 7709 S. Morgan St., Chicago, Ill., The J. B. Ford Co.

Leyerle, Arthur R., 3595 W. 47th St., Cleveland, Ohio, Vitreous Enameling Co.

Lindsay, R. D., W. 16th Ave. and Clay St., Denver, Colo., Supt., The Denver Pressed Brick Co.

Lippert, Walter T., 1322 Broadway, Alton, Ill., Illinois Glass Co.

Llige y Pages, Juan, 304 Consejo de Ciento St., Barcelona, Spain

Lockwood, L. J., 106 Hampton St., Bridgeton, N. J., Illinois Glass Co.

McGean, Ralph L., 545 Hanna Bldg., Cleveland, Ohio, Harshaw, Fuller & Goodwin Co.

Mahoney, Frank B., Chattanooga, Tenn., Asst. Supt., Crane Enamel Ware Co.

Marsh, Charles M., Illinois Glass Co., Bridgeton, N. J., Gen. Supt., Cumberland Plants
Meissner, Max, 201 Chestnut St., Hoopeston, Ill., Sprague Canning Machine Co.
Millar, James B., Box 248, Poteau, Okla., Treas., Athletic Mining and Smelting Co.
Mills, Harry R., 255 N. Hoyne Ave., Chicago, Ill., L. W. Wolff Mfg. Co.
Moellering, Walter S., 414 Montgomery St., Fort Wayne, Ind., Mgr. of Sales Promotion, William Moellering's Sons.
Morris, Bert W., 5049 Murdock Ave., St. Louis, Mo., Supt., Parker Russell Mining and Mfg. Co.
Nelson, L. C., Peru, Kansas, Mgr., Mid-Continent Clay Co.
Nickerson, F. P., 8100 Broadway, Cleveland, Ohio, Engineer, The W. S. Tyler Co.
Niegsch, Paul H., Scranton, Pa., Scranton Enameling Co.
Oberlin, John F., 1021 Society for Savings, Cleveland, Ohio
Redrow, Walter L., 3533 Thirteenth St., N. W., Washington, D. C., U. S. Patent Office
Reed, Robt. R., Rockefeller Hall, Ithaca, N. Y.
Renkert, Oliver W., Canton, Ohio, Vice-Pres. and Gen. Mgr., Metropolitan Paving Brick Co.
Riddell, Wallace C., 1429 LeRoy Ave., Berkeley, Cal., Chemical Engineer
Roth, H. A., 463 East 28th St., Brooklyn, N. Y., Lalance & Grosjean Mfg. Co.
Schreiber, George L., Box 265, Santa Monica, Cal.
Seelig, Albert F., 2193 Railway Exchange Bldg., St. Louis, Mo., Industrial Furnace Engineer
Sharkey, Samuel M., Trenton, N. J., Asst. Supt., B. O. T. Mfg. Co.
Sheffield, Albert H., 1701 Prairie Ave., Chicago, Ill., American Terra Cotta & Ceramic Co.
Skinner, Ramsey, 4471 Olive St., St. Louis, Mo., Treas., Reeves & Skinner Machinery Co.
Stover, J. Homer, 176 Grant Ave., Nutley, N. J., Sales Mgr., John Johnson Co.
Stratton, Mrs. W. B., 10125 Jefferson, E., Detroit, Mich., Pewabic Pottery
Sulliva, Willard P., 110 West Plume St., Norfolk, Va., Nansemond Brick Corp.
Thomas, James R., Crawfordsville, Ind., Standard Brick Co.
Varney, William P., 133 West Washington St., Chicago, Ill., Hydraulic Press Brick Co.
Vincent, Lawrence A., 1740 East 12th St., Cleveland, Ohio, American Dressler Tunnel Kilns, Inc.
Wachovec, Peter, 2463 E. 84th St., Cleveland, Ohio, Vitreous Enameling Co.
Waggoner, Chauncey W., 730 University Terrace, Morgantown, W. Va., Professor of Physics, University of West Virginia
Widemann, R. V., 32 rue de la Grange aux Belles, Paris, France
Wikoff, Alan G., 1570 Old Colony Bldg., Chicago, Ill., Industrial Editor, *Chemical and Metallurgical Engineering*
Wilkes, Gordon B., Massachusetts Institute of Technology, Cambridge, Mass., Asst. Professor of Industrial Physics
Zur Horst, Herbert H., 1463 Greenmont Ave., Dormont, Pa., Ceramist, Vitro Mfg. Co.

CORPORATION

American Trona Corporation, 233 Broadway, New York City
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Electric Porcelain and Manufacturing Company, Trenton, N. J.
Eureka Flint and Spar Company, Trenton, N. J.
Hazel-Atlas Glass Company, Wheeling, W. Va.
Huntington Tumbler Company, Huntington, W. Va.
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Pass & Seymour, Inc., Solvay, N. Y.

Schaffer Engineering and Equipment Company, 2828 Smallman St., Pittsburgh, Pa.
Standard Sanitary Mfg. Co., Tiffin Works, Tiffin, Ohio

Play Ball

Ninety-nine new members between February 20 and March 30! This averages 25% more than the record for December, January and the first part of February. The reason for this gain is that forty-five members have been at bat, and ten of these have been up more than once. A. B. Christopher has a wicked wallop with four hits to his credit; C. H. Modes, Geo. W. Shoemaker, and D. F. Stevens each pounded the pill three times; while Ed. Brockman, L. J. Frost, James Hamilton, R. D. Landrum, F. H. Riddle and E. W. Washburn each put it over twice. Those in the one-hit column are as follows: H. C. Arnold, Davis Brown, G. H. Brown, W. F. Brown, Horace H. Clark, R. R. Danielson, W. E. Dornbach, Philip Dressler, O. V. Earl, W. J. Frey, Donald H. Fuller, Wm. D. Gates, S. Geijsbeek, M. B. Greenough, Chester H. Jones, J. T. Keenan, I. A. Krusen, R. H. McElroy, P. S. MacMichael, H. J. Mauschbaugh, G. F. Metz, Edward Orton, Jr., Wiley T. Rabun, B. S. Radcliffe, H. Ries, H. H. Sortwell, Stockton Fire Brick Company, C. W. Thomas, Leo Thürlimann, Karl Türk, S. F. Walton, Wm. W. Wilkins. Corporation Members were secured by G. C. Kalbfleisch, F. G. Lord, and Karl Türk. Members obtained through the Secretary's office, which are not included above, bring the total to eighty-one Associate and ten Corporation memberships.

This is the kind of work that counts. If forty-five *more* members will enter into the game this month, there ought to be another increase of 25%. Do you want to send a sample copy of the *Journal*, or material descriptive of the Society, to a "Prospect?" Let the office of the Secretary help you.

Your Dues are Paid

If they were not, you would not have received this number of the *Journal*. If the other fellow in your department has not received his copy, ask him if his dues are paid. He may be one of the three hundred members who have not paid for 1922. This means that he will not receive the April and subsequent numbers of the *Journal* until he pays up. We do not like to cut his name off the mailing list but postal regulations demand it. The missing numbers will be supplied when he "comes across," but it will not be much fun for him to get nine numbers of the *Journal* all at once next December. Tell him to take the price of two seats at a Shakespearian play, which he would not go to anyway, and send it to us now. Everybody has $7.50 the first week in the month.

WHO'S WHERE IN THE AMERICAN CERAMIC SOCIETY

Gail Truman has gone to Glendale, Cal., where he will be associated with **F. B. Ortman** at the Tropico Potteries, Inc. **B. S. Radcliffe,** formerly of Des Plaines, Ill., takes Mr. Truman's place at the St. Louis Terra Cotta Co.

Leon J. Frost, lately connected with the Phillips & Clark Stove Co., Geneva, N. Y., has returned to Cleveland, Ohio, to be with the Vitreous Enameling Co., of which **R. D. Landrum** is now vice-president.

George A. Loomis, lately with the Bureau of Standards, is with the Ohio Valley Clay Co., at Steubenville, Ohio.

L. H. Hart, after some time as manager of the Construction Department of the National Lime Association, has established "Building Lime Service" at Buffalo, N. Y.

E. F. Theobald has recently taken a position with the Metropolitan Paving Brick Co., at Canton, Ohio.

J. A. Nagle was in the office of the General Secretary recently, having taken up his residence in Columbus, as representative of the Pittsburgh China Co.

F. K. Pence, President of the American Ceramic Society during 1921, has been with Knowles, Taylor & Knowles, of East Liverpool, since January first.

NECROLOGY

Merritt Brooke Cheney was born in Mechanicsburg, Ohio, June 30, 1886, and died at Grant Hospital, Columbus, Ohio, on December 24, 1921, after an illness of eleven days. Mr. Cheney was graduated from Ohio State University in the Department of Ceramics in 1909. For seven years he engaged in consulting ceramic engineering work, the last four years of this time at Inglewood, Ontario, where he built and operated a plant successfully until the war necessitated shutting down and Mr. Cheney returned to the States. He was commissioned as First Lieutenant in the Chemical War Service and worked at Cleveland and Zanesville on charcoal for gas masks. His discharge from the army did not come until April, 1919, when he, with Capt. Barneby, formed the Barneby-Cheney Engineering Company, at Columbus. Plans were being made for a new plant at the time of Mr. Cheney's death. He is survived by his wife and three sons, to whom the sympathy of his friends in the American Ceramic Society is extended.

Thomas L. Strong, born in Frankfort County, Kansas, April 27, 1866, died at his home in Coshocton, Ohio, September 5, 1921. He began his business career in early life, being associated with the Novelty Stamping Company of Bellaire, Ohio, and a little later with the Enterprise Stamping & Enameling Company, of the same city. In 1903 he organized The Strong Enameling Company, which was later changed to Strong-Batelle Mfg. Co., and 1909 the name was again changed to The Strong Mfg. Co. In 1912 a new plant was built at Sebring, O. Owing to ill health he retired from business in the spring of 1919 and located at Coshocton, O.

A few months later, seeming to have recovered from his breakdown, he became interested in the Lafayette Stamping & Enameling Company of West Lafayette, Ohio. There was a recurrence of his trouble, and he was obliged to retire from business again.

He was a man of strong Christian character; a hard and consistent worker and a close student of business and economic conditions; sharing with his employees the profits of his business. His sterling character and congenial good nature won for him the love and esteem of all who knew him.

BULLETIN

of the

American Ceramic Society

A Monthly Publication Devoted to Proceedings
of the Society, Discussions of Plant Problems, Discussions
of Technical and Scientific Questions and
Promotion of Co-operative Research

Edited by the Secretary of the Society Assisted by Officers of the Industrial Divisions

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B. T. Sweely, R. R. Danielson } Enamel
J. C. Hostetter, A. E. Williams } Glass
J. S. McDowell, F. A. Harvey, F. K. Pence, C. C. Treischel } Refractories
A. F. Hottinger, R. L. Clare } Terra Cotta
C. F. Tefft, M. B. Greenough } Heavy Clay Products
White Wares

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Vol. 1 June, 1922 No. 2

EDITORIALS

THE BULLETIN, A FORUM OF MUTUAL HELP

Workers and foremen at the leer, the press, the kiln, in the dryroom, or the decorating shop know a great deal. They can express it in the language of the shop and this is the language that directs the making of the output. They must be encouraged to talk, made to feel that what they know is important, given aid if needs be in writing out their observations. They must learn that "Ceramics" is not high-brow stuff, however much we have to concentrate on the chemistry and physics of it. Nobody ever made ware from mixtures of feldspar, kaolin, fluorspar, etc., that are expressible in exact chemical formulae. The empirical formulae which we use are abstractions and we know it. They are chemical and physical modifications; a means of codifying results; a systematic means of analyzing the empirical observations made in the shop. But we can not analyze intelligently, if we do not have record of observations from the many shops.

The *Journal* is recording observations from many laboratories, but substantial progress can be made much more rapidly and with much less expenditure of time and material if the factory operators will in like manner make record of their observations. The operator is naturally abashed by the ability of expression of the theoretically trained man. Some operators are confused by the idiom in which these trained men write. Too often they try to hide it by pretending to understand, and then creep into

their shells. And often they have a chance to see, in the pitiless logic of results, that college training has not always made for either judgment or straight reasoning.

If all are to profit most, the hand of equal fellowship must be extended. The *Bulletin* is the medium for doing this. It is to be hoped that many of our technical men will present in these columns concrete applications of the results of research to concrete problems of plant operation. The operators must profit by these, hence the language must be their language, which does not mean, of course, a perversion of English, but freedom from the abstractions and condensations they do not use or understand. The spirit should not be that of instruction, but the giving of information to draw out information in return.

Should not this platform of information and interchange of practical and scientific observation be of mutual advantage?

KARL LANGENBECK

THE AMERICAN CERAMIC SOCIETY AND THE POTTERY INDUSTRY

More than ever there is need at the present time of a clearing house for the collection and distribution of technical information pertaining to the pottery industries. Without underestimating in the slightest degree the ability the American manufacturers have shown in advancing and extending their business it is a fact that at no time has it been so essential that the knowledge of raw materials and the study of processes be brought to a new level of accuracy and reliability. It is only in this way that competition, both foreign and domestic, can be met adequately.

It is necessary in the first place that we learn to differentiate the various raw materials now on the market and new ones as they may appear, and to purchase them on the basis of specifications which are fair and equitable and which have a legal status. Such specifications would be a protection both for the buyer and seller and would eliminate the uncertainty which often exists as to the qualities really desired. Again, there are many questions relating to factory operations and the fundamental principles involved upon which further light is necessary, in order that the burden of responsibility and uncertainty under which the master potters labor may be lightened. We need only cite a few of the difficulties which constantly appear such as crazing, dunting, blistering and splitting out. We need more information concerning the best sagger mixtures and their most thorough preparation. Again, we certainly must work toward a solution of the firing problem. What improvements can be made in existing kilns and what type of kiln is to be adopted in the future? In brief, there is distinct need of solving these general problems by co-operative effort.

In doing so collectively we need not interfere with individual effort or encroach upon the work of plants who conduct investigative work of their own, since some of the questions confronting us are too large to be solved by any single firm, no matter how strong its position may be.

It is in this work that the American Ceramic Society may be of great value. The Society therefore invites the co-operation of the manufacturing potters. It is the one agency best equipped to do such work and to render service of a kind which will help place our pottery industries in the lead. It is to be hoped that all who are engaged in the pottery industry or connected with it will identify themselves with the Society and take an active part in the work of the division dealing with white wares

ALBERT V. BLEININGER

THE ART DIVISION

Its Activities and Its Possibilities

This is one of the seven Divisions of the American Ceramic Society for the promotion of Ceramic Arts and Science. The Division recognizes that Ceramic Technology and Science must go hand in hand with craftmanship if there is to be the fullest development of the Ceramic Art profession.

The artist who attains the largest success has a working knowledge of the materials with which ceramic wares are fashioned and decorated. Modeling, sculpture, design and coloring; the use of pastes, glazes and stains to produce commercial ware that is distinctive and pleasing to the eye; these are the tasks of the artist. The production of ceramic bodies, glazes, pastes and stains suitable for ware that shall be both serviceable and artistic is the task of the ceramist. It is self-evident that a working knowledge of the media with which the artist works and of the methods employed in fabrication of ceramic wares is necessary before an artist can create ceramic art pieces.

The "Lost Art in Potting" is a divorcement of the creative ability of the artist and the knowledge of the ceramist. To him who has available both the knowledge to compound and the ability to fashion and decorate, there is no such thing as the "Lost Art in Potting."

It is significant that the highest quality wares are made in those countries where the young potter not only serves apprenticeship in a pottery but also has opportunity to attend art schools in which he learns the art of fashioning and the science of compounding.

The Art Division of the American Ceramic Society was organized in recognition of the industrial need for co-ordinating Ceramic Art and Ceramic Science. This Division will succeed in this only to the extent to which the artists co-operate. This is an opportunity for the artists to join with

the ceramic technologist in making possible a distinctive American Ceramic art in American studios, clubs, schools and industry.

Program of Activities

1. **Activities in the Interest of the Novice Ceramic Artist.**—American artists of School and Club are interested chiefly in faience and majolica tile and pottery. To them the decorative possibilities of the different types of enamels, mat, crystalline and colored glazes, and the possibilities of each type at different heat treatments are for the most part unknown. Knowledge of under-glaze pastes, their composition, preparation, and use is not generally possessed by these novitiate artists.

The Art Division of the American Ceramic Society will give the opportunity for those who join in support of the Society by membership subscriptions to collaborate with the ceramic technologists in furnishing information regarding:

(*a*) Clays, body mixtures, methods, glazes, colors, firing, etc.
(*b*) Courses of instruction.
(*c*) Equipment.
(*d*) Sketches of shapes and designs.

2. **Activities in the Interest of the Industrial Artist.**—The many methods employed in decorating ceramic ware will be described and illustrated and advice given on suitability of each to particular types.

3. **Activities in the Interest of Ceramic Art and Technical Schools.**—The stress that is given abroad to the importance of private and Government schools for the teaching of Ceramic Art and Science is evidence that worth-while returns have been enjoyed.

The promotion of industrial schools, in collaboration with the White Wares Division, for the teaching of ceramic technology and ceramic technique will be one of the activities of the Art Division.

The Value of Membership in the American Ceramic Society to Ceramic Artists

1. This is the only national organization that gives opportunity for the ceramic artist to collaborate with the ceramic technologist.

2. Opportunity will be given to obtain information on ceramic mixtures for all sorts of decorative purposes.

3. Opportunity for discussion and exchange of experience will be found in the *Bulletin*.

4. Information regarding equipment and supplies for studios will be given when requested.

5. Description of methods of preparing the materials for and the shaping of wares will be made, including drawings, etc.

6. The Art Division will in fact be a "collective bargaining" for the advisory services of the best ceramic technicians and artists.

7. Compilation of "up to the minute" information on all sorts of items of value to ceramic artists will be published and sold to members of the Society at a large reduction. At the present time members receive a forty per cent reduction on all publications of the Society.

8. The extent to which the program of activities here outlined can be carried through is in direct proportion to the support given by the ceramic artists. Can any ceramic artist afford to refuse his share in making this possible?

9. The Society has served the ceramic interests well and with increasing success for twenty-four years. It is not a new or novel enterprise and has thoroughly proved its capacity and ability.

OUR BUDGET FOR 1922

On page 124 of the Abstract Section of the April issue of the *Journal* is the budget for the calendar year 1922. Summarized, the figures are as follows:

Income		Expense	
Membership Subscriptions	$19,000.00	Publications	$18,575.00
Advertising	17,700.00	Commission	4,185.00
Other Incomes	3,180.00	Executive	12,620.00
	$39,880.00	Divisions and Committees	4,500.00
			$39,880.00

These figures set the goal to be attained this year in facilities for service. If the Society is to give the service which the Board of Trustees decided should be the minimum during 1922 it will be necessary to realize a net increase of 300 Associate Members at $7.50 and 150 Corporation Members at $25.00 per annum; and it will be necessary to sell about $2000 more advertising.

Object of the Society.—Certainly the prime objective of the Society is not the publication of a journal. If issuance of a journal were the chief objective, the Society is proceeding in a very unbusinesslike fashion. The *Journal* is essential to the fundamental purposes of the Society but it is in no wise a commercial proposition.

The *Journal* is a record of researches made, and a medium for promoting organized research. It is the most important of the working tools of the Society.

The service rendered by the contributors, the abstractors, and the associate editors is of inestimable value. The "goods delivered" by the Society are in the *Journal*. It is a record of the things accomplished not only by our own members but by all investigators the world over. The

Journal, however, never has been and never will be the motivating and activating reason for ceramic craftsmen, executives and technologists giving support to the Society. More subscribers to the work of the Society are desired that the Society may the more efficiently and effectively promote the Ceramic Arts and Sciences by laboratory investigations and plant application and not simply to support the publication of a journal. The requirements of these industrial times are more exact information of all sorts, a more thorough knowledge of how to effect economies and of how to meet the market specifications as to quality. The obtaining and the applying of such knowledge is the prime purpose of the Society. Such service when rendered will bring cash profit to the employee for thereby his value to his employer is increased. Such service will bring cash profit to the corporations that make plant application of the things thus discovered and proved.

The budget figures show what is needed by the Society if it is to meet its obligations in the big scheme of co-operative research demanded by present industrial conditions, and if it is to be of the value to its subscribing members which they have a right to expect.

The Society needs more effective working tools if it is to serve the ceramic crafts in the fashion and to the extent demanded of it. The production of the sort of information and the publication of it in the sort of journal which these times require costs real money.

This is the why and the wherefore of the goal of 300 more personal members at $7.50, 150 more corporation members at $25.00 per annum, and increased advertising.

ACTIVITIES OF THE SOCIETY

Facts about the Summer Excursion to England and Europe

Date of sailing	August 22, 1922
Steamer	Aquitania, Cunard Line
Cost of passage, one person one way	$280.00
Latest date for taking up reservations	June 29, 1922
Person to be notified	Dr. E. W. Tillotson, Mellon Institute, Pittsburgh, Pa.
Duration of visit in England	About three weeks
Special arrangements made for visits to plants	Glass, White Wares, Refractories

Trips to the continent to be arranged individually with the assistance of Dr. Turner and Dr. Endell.

A special and urgent invitation has just been received from Vereinigte Grossalmerode Thonwerke, Grossalmerode, Germany, for us to visit them under the guidance of Dr. Endell.

The actual railroad travel will amount to about $40 and the hotel expenses will depend upon the class of hotels selected. One can certainly plan on $1000 to $1200 as a minimum for the entire trip.

Summer Meeting August 14–19, Inclusive

Toronto, Hamilton, Montreal, Kingston and Quebec

The committee arranging for the summer meeting consists of

Millard F. Gibson, *Chairman*, The Interlocking Tile Co., Toronto.
N. B. Davis, O'Brien and Fowler, Ottawa.
L. H. Cole, Department of Mines, Ottawa.
Howells Frechette, Department of Mines, Ottawa.
G. Percy Cole, Dominion Glass Co., Montreal.
H. F. Dingledine, National Fire Proofing Co., Hamilton.
R. F. Segsworth, Feldspars Ltd., Toronto.
Everett Townsend, Frontenac Floor & Wall Tile Co., Kingston.
Randal K. Robertson, Cooksville Shale Brick Co., Cooksville, Ont.

The itinerary of ceramic plants and mines to be visited has not been worked out. Sufficient is it to tell at this time that no more pleasant week's jaunt could be planned. It will give opportunity to renew friendships and to spend restful hours on lake steamers. Modern plants of all sorts as well as feldspar mines will be visited. The route will probably take us down the Niagara Gorge from Niagara Falls to Lewistown, across Lake Ontario to Toronto, along the full length of the Lake, through the Thousand Islands, shooting the rapids in the St. Lawrence River and landing at that historic city, Montreal.

Details of cost and schedule will be announced as early as possible but this much is certain: no one can plan a more delightful summer excursion than that which the committee is arranging for the week of August 14.

Annual Convention of the Society

February 12 to 17, inclusive, Pittsburgh, Pa., is the time and place of the 1923 Annual Convention of the American Ceramic Society.

This will be the 25th anniversary, the Silver Jubilee celebration. It was in Pittsburgh that Elmer Gorton and Sam Geijsbeek made the proposal to Professor Orton that a Ceramic Society be organized, and it was in Pittsburgh that Professor Orton called together the first group of ceramists at that time and laid plans which developed into the incorporation of the American Ceramic Society.

The charter members are planning to make the first day of this convention a big occasion in the interest of Ceramic Science and Technology. The men who are doing big things for Ceramics will be with us on that day.

Calendar of Conventions

Electrical Manufacturers Club—Hot Springs, Va., second week of May, 1922, Fred L. Bishop, Sec., Hartford Faience Co., Hartford, Conn.

National Association of Purchasing Agents—Rochester, N. Y., May 15–20, 1922, H. R. Heydon, Sec., 19 Park Place, New York City

National Coal Association—May 17, 1922, W. B. Reed, Sec., 200 Commercial Bank Bldg., Washington, D. C.

American Society of Refrigerating Engineers—Detroit, Mich., May 24–26, 1922, W. H. Ross, Sec., 154 Nassau St., New York City

American Boiler Manufacturers Association—Stockbridge, Mass., May 29–31, 1922, H. N. Covell, Sec., 191 Dyckman St., Brooklyn, N. Y.

Ceramic Society (England)—trip to Sweden and Denmark, May 27–June 10, 1922, J. W. Mellor, Sec., Stoke-on-Trent, England

Tile Manufacturers Credit Association—June, 1922, F. W. Walker, Sec., 1 Reeves Bldg., Beaver Falls, Pa.

American Association of Engineers—Salt Lake City, Utah, June 4–6, 1922.

Electric Power Club—Hot Springs, Va., June 5–7, 1922, S. N. Clarkson, Exec. Sec., 1017 Olive St., St. Louis, Mo.

American Foundrymen's Association—Rochester, N. Y., June 5–9, 1922, C. E. Hoyt, Sec., Marquette Bldg., Chicago, Ill.

American Institute of Chemical Engineers—Niagara Falls, Ont., June 19–22, 1922, J. C. Olsen, Sec., Polytechnic Institute, Brooklyn, N. Y.

American Construction Council—Washington D. C., June 19–20, 1922; Organization Meeting

American Association for the Advancement of Science—Salt Lake City, Utah, June 22–24, 1922

American Society for Testing Materials—Atlantic City, N. J., June 26–July 1, 1922, C. L. Warwick, Sec., 1315 Spruce St., Philadelphia, Pa.

International Union of Pure and Applied Chemistry—Lyons, France, June 27–30, 1922.

National Bottle Manufacturers Association—July, 1922, C. R. Stevenson, Bus. Mgr., 120 Broadway, New York City

Annual Safety Congress of the National Safety Council—Detroit, Mich., August 28–September 1, 1922

American Chemical Society—Pittsburgh, Pa., Sept. 5–9, 1922, Charles L. Parsons, Sec., Washington, D. C.

Association of Iron and Steel Electrical Engineers—Cleveland, Ohio, September 11–15, 1922, John F. Kelly, Sec., Empire Bldg., Pittsburgh, Pa.

Eighth National Exposition of Chemical Industries—New York City, September 11–16, 1922

American Electrochemical Society—Montreal, Canada, September 21–23, 1922

National Association of Commercial Organization Secretaries—Chicago, Ill., October 23–25, 1922, John E. Northway, Sec., Hamilton, Ohio

National Exposition of Power and Mechanical Engineering—New York City, December 7–13, 1922

American Malleable Castings Association—January 10, 1923, Robt. E. Bolt, Sec., 1900 Euclid Bldg., Cleveland, Ohio

National Jewelers Board of Trade—New York City, Jan. 18, 1923, F. C. Backus, Sec., 15 Maiden Lane, New York City

American Concrete Institute—February, 1923, Harvey Whipple, Sec., East Grand Boulevard at Moran, Detroit, Mich.

Optical Manufacturers Association—Monthly meetings, Ernest H. Gaunt, 511 Westminster St., Providence, R. I.

Gypsum Industries Association—H. H. McDonald, Sec., 111 Monroe St., Chicago, Ill.

National Lime Association, June 14–16, Hotel Statler, Cleveland, Ohio

The Third Conference of the International Union of Pure and Applied Chemistry, June, 1922

The details concerning the importance of this conference are set forth editorially in the March issue of this *Journal*. Dr. E. W. Washburn with Dr. E. Ward Tillotson as alternate has been placed in nomination to the Division of Chemistry and Chemical Technology of the National Research Council as official representative of the American Ceramic Society.

Inter-Departmental Committee on Specifications for Refractories

The Bureau of Standards has been charged with the task of preparing specifications for refractories used by the various Federal Departments. The Bureau has asked the assistance of representatives of various industries to constitute an advisory committee and has also asked that the General Secretary of the American Ceramic Society serve as official representative of the Society. In conformity with this request the Board of Trustees has appointed Secretary Purdy as the Society's official representative.

All of the official personnel of the Refractories Division are serving on this Advisory Committee, having been appointed as official representatives of industrial groups.

The American Federation of Arts

This federation held its thirteenth annual convention in Washington, D. C., May 17–19, inclusive. Mr. Frederick H. Rhead, chairman of the Art Division, was appointed by President Riddle as delegate representing the American Ceramic Society.

Research Committee U. S. Potters Association

The meeting of the Research Committee of the U. S. Potters Association was held at the Bureau of Standards, Washington, D. C., on April 25th.

Tentative specifications for hotel ware were discussed and it was suggested that for vitreous ware the absorption for all hollow and flat ware, up to and including 8 inch dishes

should not exceed 1 per cent. No absorption requirement should be made for semi-vitreous ware. All ware, both vitreous and semi-vitreous should be required to withstand a quenching test from 175 degrees C to the temperature of tap water, repeated until it has been made five times. No items larger than five inches should be used for this test. The vitreous ware should be subjected to an impact test and should withstand a blow equivalent to 0.175 foot pound. No impact test should be required for semi-vitreous ware. Further work is to be done on the chipping, and abrasion tests and the effect of thickness upon the impact test is to be further investigated.

Mr. Larkins reported upon the use of cement for cases and the design of a kiln damper, Mr. Sproat on the use of cobalt sulphate as stain, Mr. Walker upon kiln dirt and saggers, Mr. Pence upon chemical tests for materials and Mr. Bleininger upon the question of normal water content of the materials and the control of the casting slip.

A discussion took place also of the possible standardization of the shapes and sizes of the most commonly used pottery items and the Bureau of Standards has agreed to undertake work along these lines. A comprehensive collection of different articles is to be arranged at the Bureau and a systematic survey of the situation attempted. It is hoped that at least for the purposes of the Government the shapes may be reduced in number and the sizes specified in a more satisfactory way.

National Research Council Division of Chemistry and Chemical Technology Annual Meeting

Excerpt from minutes of the annual meeting of the Division of Chemistry and Chemical Technology, held at the offices of the National Research Council, 1701 Massachusetts Avenue, Washington, D. C., April 24, 1922.

Present.—Messrs. W. D. Bancroft, A. V. Bleininger, F. G. Cottrell, Colin G. Fink, C. H. Herty, H. K. Moore, R. B. Moore, A. A. Noyes, Julius Stieglitz, E. W. Washburn. By invitation: Messrs. C. L. Parsons and C. J. West. Mr. W. Nichols acted as Secretary of the meeting.

Committee on Ceramic Research.—A. V. Bleininger, Chairman. Mr. Bleininger presented a brief report in behalf of his committee, stating that there had been no meeting of this joint committee during the past year, principally for two reasons—(1) the depressed state of the industries, and (2) the reorganization of the American Ceramic Society, which has expanded its activities and has created a permanent organization of well defined divisions. It is now proposed to offer to the National Research Council co-operation through a research committee composed of three members-at-large and one member chosen by each of seven divisions which represent the different industrial groups. As a result of this plan the present joint committee between the American Ceramic Society and the National Research Council should be discharged.

Mr. Cottrell then read a communication from the General Secretary of the American Ceramic Society, stating that the Society was now engaged in a complete reorganization, and that at the last meeting, February 27–March 3, in view of the contemplated changes in method of contact with the National Research Council, the joint committee between it and the National Research Council had been abolished, and that when the reorganization shall have been completed it is intended to make a presentation of this organization to the National Research Council with the purpose of developing the co-ordination in purpose and effort.

It was thereupon

Moved: That the report of the chairman be received and filed, and that the joint committee on Ceramic Research be discontinued.

Adopted.

Directory of Laboratories for Tests and Analysis of Ceramic Materials

A member of this Society wanted analysis made of some clays and after several unsuccessful enquiries sent his clays to England. Such enquiries come to the several federal bureaus and departments and to the ceramic departments of the Universities every week. Certainly there should be no difficulty in obtaining reliable tests and analysis of ceramic materials. There are several who are equipped to do such commercial testing.

The Board of Trustees of the American Ceramic Society has decided that the maintenance of a directory of laboratories in position to do commercial testing is one of the services which the Society should render. Those who will do such commercial testing are requested to give the Secretary's office (in confidence) a schedule of their facilities and charges. Members of the Society are asked to send in names of those by whom this notice will not be read.

The Secretary's office is now in co-operation with the U. S. Geological Survey in finding opportunities for such testing and it is intended that this co-operation shall be made general.

Here is opportunity for every member of the Society to co-operate in an enterprise for which there is an immediate demand. It is hoped the response to this appeal will be large.

On page 20 of the Advertising Section of the May issue there is a plan for classified advertising which will help to get these names before the public.

University Extension Courses

One of the first tasks of the Committee on Ceramic Education as provided by the amendment to the Constitution recently adopted, will be to develop the possibilities of University Extension Courses for persons employed in the ceramic industries. Dr. E. Ward Tillotson has been asked by the Board of Trustees to make a preliminary survey.

Here is an illuminating enquiry recently received.

> A little nigger "Carry-in-boy" in a Machine-Made Bottle Factory once made a suggestion that all of the mechanical genius had been over-looking for several years. The rest of that nigger's idea until he is 1256 years old may not be worth anything, and the one I want to spill at this time may not be either, but it can be disposed of quickly anyway.
>
> I got a list of the courses offered by the University Extension Division of University of Wisconsin recently to figure on some spare time work for myself, and it just occurred to me that the Glass Division of the American Ceramic Society could arrange with them for a selected course and endorse it for use by men in the factory like myself who never had the opportunity to take a resident school course. This, in time, would do the industry a lot of good.
>
> Regular subjects which the University of Wisconsin Extension offers that I notice are: "Heat," "Fuels," "Gas Producers" and "Compressed Air" in their Mechanical Engineering list, and "Elementary Geology," "Elementary Chemistry" and "Mineralogy."
>
> Could you not get such a course endorsed for men who do not know where to look for what will help them most?

Amendments to the Constitution

Out of 525 possible votes on the Amendments to the Constitution, 103 were cast with the following result:

Proposed Amendments	Yes	No
Wherever a representative of a Division or Section is indicated as a member of a committee, the words "selected by" shall be substituted for any phraseology used.	94	2
Article VI, Paragraph 1. "(10) Ceramic Education."	97	
Paragraph 13. "The Committee on Ceramic Education shall consist of a Chairman appointed by the Board of Trustees and one representative selected by each Division. This Committee shall make recommendations through the Board of Trustees for the betterment of ceramic education in institutions now established and for the encouragement of new departments of ceramics where the demand and facilities warrant."	97	1
Paragraph 14. "The Coördinating Service Council shall consist of the General Secretary, ex-officio chairman, and the chairmen of the Committees on Research, Standards, Geological Surveys, Data, and Ceramic Education. The Council shall have general supervision of the work of these Committees for the purpose of coördinating their work within the Society and with the work of other organizations on ceramic topics and problems."	101	1
Article X, Paragraph 1. "The Board of Trustees shall employ at suitable compensation an Editor of the Journal of the Society and an Advertising Manager, both of whom shall be nominated by the Committee on Publications to the Board of Trustees."	95	4

Each Amendment, therefore, is carried and, according to rule, at once becomes effective.

Membership Record

As might have been expected, the pace shown during and immediately after the Annual Meeting was too fast to continue. We have dropped a long distance to twenty-six new members in April. There is a gratifying side to this, however, in that thirteen of the twenty-six are Corporation Members. Supposing half of the members last month had been Corporation!

Also we call the attention of the general public to the record of the White Wares Division—eight new Corporation Members and three Associates. No other Division can compare with this, although each contributes some. The Heavy Clay Products Division has two Corporation and one Associate; the Enamel Division has one Corporation and two Associate; the Refractories Division has four Associate, and the Art and Glass Divisions have one each. There are two Corporation Members and one Associate not identified with any Division.

Analyses of the various industries have been undertaken by the office of the Secretary, showing the amount of representation in the Society held by each firm, and also showing the possibilities of the field. With this aid, and with renewed effort by officers and members, it should be possible to chalk up a better record next month.

One man alone is responsible for *six* of the Corporation and *one* of the Associate Members of the White Wares Division. He secured them by writing personal letters to a group of prospects. Another man sends in an average of one Corporation and one Associate Member *every month*. He does not make any noise but he writes *personal* letters.

How about writing two letters every day this month to persons you know who should be members? Have a sample copy of the new *Journal* sent to them and *write*.

New Members Received during April

ASSOCIATE

Armstrong, M. K., Hampton, Va.
Bentley, Fred, 72 Kelsey Ave., Trenton, N. J.
Bown, L. H., Buffalo, N. Y., General Manager, Buffalo Pottery
Butler, M. W., 14619 Coit Road, Cleveland, Ohio, Research Engineer, The Glass Coating Co.
Greene, Joseph F., 740 Pear St., Vineland, N. J., Kimble Glass Co.
Lodwick, J. A., 17 East 42nd St., New York City, American Arch Co.
Moodie, David M., Norwood, N. C.
Morgan, F. A., Anaconda Lead Products Co., Chicago, Ill.
Rivière, Mme. Jean, Jopyma Route du Cap-Brun, Toulon (Var), France
Seaton, Max Y., Sierra Magnesite Co., Porterville, Cal.
Vodicka, Albert L., Aetna Porcelain Enameling Co., 4701 Augusta St., Chicago, Ill.
Whipple, Allen D., 5241 N. Kimball Ave., Chicago, Ill.
Wildblood, A. F., 28 Wall St., Trenton, N. J.

CORPORATION

Batchelder-Wilson Co., 2633 Artesian St., Los Angeles, Cal.
Buffalo Pottery, Buffalo, N. Y.
Canonsburg Pottery Co., Canonsburg, Pa.
Canton Brick and Fireproofing Co., New Philadelphia, Ohio
Cook China Co., Trenton, N. J.
Crown Potteries Co., Evansville, Ind.
Interstate Corporation, Trenton, N. J.
Michigan Stove Co., Detroit, Mich.
National Lime Association, Washington, D. C.
Pope-Gosser China Co., Coshocton, Ohio
Stevens Bros. & Co., Stevens Pottery, Ga.
Western Electric Co., Hawthorne Station, Chicago, Ill.
H. R. Wyllie China Co., Huntington, W. Va.

Associates Elevated to Active Membership by the Board of Trustees, April, 1922

Abrams, Duff A.
Acheson, E. G.
Bachman, P. S.
Bacon, Charles C.
Baggs, A. E.
Bartells, H. H.
Beasley, H. C.
Bitting, A. W.
Brand, J. J. Fred
Bray, Archie C.
Brenner, R. F.
Buck, D. M.
Chandler, A. H.
Cooper, George W.
Crume, William H.
Dailey, Ernest W.
Dalton, Richard F.
Darlington, Homer T.
Davis, Harry E.
Donahoe, Frederick W.
Farren, Mabel C.
Flagg, F. P.
Flint, Francis C.
George, W. C.
Goodner, Ernest F.
Grant, W. Henry
Greenough, M. B.
Greenwood, G. W.
Hansen, J. E.
Helser, P. D.
Hill, Charles W.
Hill, James H.
Holmes, M. E.
Hower, H. S.
Hudson, Charles J.
Hunt, F. S.
Justice, I. M.
Keehn, C. C.
King, Earl O.
Knowles, Homer
Langworthy, H. S.
Larkins, Samuel
Leibson, J. S.
McDowell, S. J.
McGee, Earle N.
Manson, M. E.
Menne, L. H.
Merica, Paul D.

Moulton, D. A.
Muessig, C. N.
Parker, George W.
Pfalzgraf, Chas. F.
Randall, James E.
Reinecker, H. P.
Rusoff, Samuel
Schaeffer, John A.
Schramm, Edward
Smith, Perry A.
Smoot, C. E.
Stone, George C.
Thomas, Richard G.
Thwing, C. B.
Twells, Robert, Jr.
Vincent, Harry S.
Wainford, R. H.
Walker, Chas. H.
Weller, S. A.
Young, Russell T.
Zwerman, Carl H.

Who's Where in the American Ceramic Society

A note to the members: We try to keep the membership list constantly corrected. Naturally, however, changes of position and address are not known unless they are sent in. Sometimes we see notices in other periodicals touching the personnel of our membership. We always feel slighted when this occurs because we like to get the information direct. If we do not have correct addresses the Journal is not received, communications are lost, and both sides suffer. We wish members would make a point of notifying us when changes in address or position are made. It would help us to keep our records complete also if the company and position were always mentioned in such notification.

Robert E. Anderson is now associated with the Robertson Art Tile Co., at Trenton, N. J.

James L. Austin has recently accepted a position with the Carborundum Co., at Niagara Falls, N. Y.

George Blumenthal, Jr., has left the Bureau of Standards and is at Alfred, N. Y., where he will assist Professor Binns in the summer session of the Ceramic Department.

William B. Cleverly, formerly of Stoke-on-Trent, has become connected with the Carborundum Co. Ltd., at Manchester, England.

Paul P. Francais is now Enameling Superintendent of the A-B Stove Co., at Battle Creek, Mich.

H. W. Douda left the Bureau of Mines on April first and went to the National Fire Proofing Co., at East Palestine, Ohio.

Herbert Goodwin is superintendent of the Crescent China Co., Niles, Ohio.

H. W. Jackson has returned to DuBois, Pa., and is general manager of the Jackson Vitrified China Co.

T. A. Klinefelter, formerly superintendent of the Atlantic Terra Cotta Co., Tottenville, Staten Island, has gone to Trenton, N. J., where he is general manager of the pottery branch of the J. L. Mott Co.

G. Z. Minton, who is with the Pittsburgh Plate Glass Co., has been transferred from Creighton, Pa., to Kokomo, Ind.

William W. Paul has moved from Detroit, Mich., to Scranton, Pa.

A. E. Saunders has recently become Vice-President and Superintendent of the Oriental Art Glass Co., Chicago, Ill.

C. Saxton, formerly of France, is now agent in England for manufacturers of materials and apparatus, particularly for the glass industry. His office is at 35 Bedford St., Strand, London.

H. G. Schurecht has been connected with Mellon Institute, Pittsburgh, Pa., since April first.

C. A. Underwood, of the American Refractories Co., has been transferred from Valley, Wash., to Joliet, Ill.

On May 1, 1922, **R. T. Stull** was made Supervising Ceramist for the U. S. Bureau of Mines as a whole. He will have supervision in technical matters in ceramics, and related investigation of non-metallic minerals. He will have administrative as well as

technical supervision of field work in the kiln investigation carried out in co-operation with the four heavy clay products associations, including the car "HOLMES" and its crew. He will make his headquarters at Columbus, Ohio, but his services are available for consultation by all branches of the Bureau concerned with ceramics.

George A. Bole is Acting Superintendent of the Ceramic Experiment Station, at Columbus, Ohio, and as such acts in an advisory and consulting capacity to the Station in all of its ceramic work.

Say it with Words

We have been comparing the advertising pages of some numbers of the *Journal of the American Ceramic Society*. The figures are given below:

Space	Jan. 1918	Jan. 1919	Jan. 1920	Jan. 1921	May 1922
Full pages	4	7	6	8	11
Half pages	6	7	9	7	12
Quarter pages	5	4	3	6	11
Eighth pages	0	0	0	1	3
Total	$8^1/_4$	$11^1/_2$	$11^1/_4$	$13^1/_8$	$20^1/_8$

This is a considerable increase but not as large as it should be, and readers of the *Journal* are partly to blame. When you write to a manufacturer, do you tell him where you saw his advertisement? This is little trouble for you, but it helps the advertiser and the periodical mightily.

One of our advertisers says that while he believes his advertisement brings him business, he has no positive proof because no one has ever said that the advertisement was seen in the *Journal of the American Ceramic Society*. Will you notify your purchasing agent, or put it in your hat, to mention the *Journal* to advertisers?

Official Personnel of Divisions 1922–23

	Art	Enamel	Glass	H. Clay Prod.	Refractories	Terra Cotta	White Wares
Chairman	F. H. Rhead	B. T. Sweely	J. C. Hostetter	C. F. Tefft	J. Spotts McDowell	A. F. Hottinger	F. K. Pence
Vice-Chairman	H. S. Kirk		A. R. Payne	D. F. Stevens	E. H. Van Schoick		
Secretary	M. C. Farren	R. R. Danielson	A. E. Williams	M. B. Greenough	Fred A. Harvey	R. L. Clare	C. C. Treischel
Committee on Research	F. H. Rhead	R. R. Danielson	E. C. Sullivan E. W. Washburn R. B. Sosman *	O. W. Renkert R. T. Stull G. W. Shoemaker Warren Griffis Paul E. Cox R. K. Hursh	R. M. Howe E. N. McGee G. F. Bissell W. E. Dornbach F. A. Harvey S. M. Kier	E. C. Hill Major Gates	F. K. Pence L. H. Bown F. S. Hunt V. S. Schory Ira E. Sproat O. O. Bowman, 2nd August Staudt Leslie Brown C. C. Treischel
Committee on Standards (*a*) Tests (*b*) Products	W. J. Stephani C. F. Binns	E. P. Poste D. F. Riess	(*a*) A. E. Williams W. F. Brown J. H. Forsyth (*b*) A. W. Bitting H. K. Kimble C. W. Parmelee R. J. Montgomery	P. H. Bates W. G. Worcester S. M. Duty R. A. Horning S. Geijsbeek	R. M. Howe E. N. McGee	(*a*) C. W. Hill D. F. Albery (*b*) J. L. Carruthers	H. S. Spurrier F. S. Hunt
Committee on Data	Conrad Dressler	R. R. Danielson	G. W. Morey W. C. Taylor G. E. Barton	H. G. Schurecht	C. W. Parmelee	T. A. Klinefelter	C. C. Treischel
Committee on Membership	W. W. Wilkins	W. C. Lindemann	E. W. Tillotson Jas. Gillinder W. S. Williams	D. F. Stevens H. S. Vincent J. E. Randall H. S. Langworthy J. J. F. Brand	W. E. Dornbach I. A. Krusen A. B. Christopher M. F. Beecher Mark Sheppard M. G. Babcock	W. D. Gates G. M. Tucker A. L. Gladding	Ira E. Sproat
Committee on Rules	F. H. Rhead	J. B. Shaw	W. M. Clark W. A. Yung C. C. Rand	C. B. Harrop R. L. Hare W. W. Ittner S. L. Galpin	E. H. Van Schoick Geo. Fisher	R. L. Clare	August Staudt
Rep. on Committee on Nominations	Paul E. Cox		C. O. Grafton	C. F. Tefft	A. F. Greaves-Walker	E. C. Hill	Herbert E. Goodwin
Councilors	Hewitt Wilson W. D. Gates Fredk. Carder Ira E. Sproat	R. D. Landrum D. F. Reiss W. C. Lindemann H. F. Staley	H. L. Dixon C. L. Grafton H. W. Hess J. W. Wright	W. N. Cary E. W. Dailey Geo. A. Bole Eben Rodgers		Geo. P. Fackt W. J. Stephani M. C. Gregory	

* Glass Division Committee on Refractories. D. W. Ross, Chr., C. O. Grafton, A. S. Zopfi, C. E. Fulton.

NOTE ON REFRACTORIES ENGINEERING[1]

By W. E. Dornbach

ABSTRACT

A brief outline of training necessary to fit one for work as a Refractories Engineer. Nature of the work, its present-day importance and one verbal illustration of the work of such an Engineer.

Refractories engineering, that highly specialized branch of ceramics engineering, while not exactly a new profession, still in a sense might be called new inasmuch as its importance in the industry is just beginning to be truly appreciated. Every now and then we hear of a student in one or the other of our excellent ceramic engineering schools, who through broad vision or the advice of some real well wisher, has elected a special course of study in Ceramic Engineering which will fit him to specialize in the branch which we have under consideration. Our ceramic schools are well equipped for this work but it remains for the student to draw from the courses offered the essentials to make him a real refractories engineer. These essentials are a careful study of the principles of mechanical and electrical engineering; a thorough mastery of the work offered in metallurgy and a complete course in ceramics, with particular attention to refractories. The writer acknowledges that this is a very stiff curriculum and one that can not be carried out in the usual four-year college course unless the student is of exceptional ability. To specialize one must either put in additional time in college or the research laboratory or spend years in the actual pursuit of his special line. It is a sacrifice of time which is justified by the opportunities afforded in the end.

Refractories engineering is work usually of a consulting nature, or has been, with some exceptions, up to this time. It is now being employed as a profession in a wider range of work. Large refractories manufacturing concerns employ refractories engineers to work out difficult refractories problems that can not be definitely solved in the laboratories. Large steel works, copper and other metal working and refining industries also are awakening to the fact that competent refractories engineers are necessary to assist in the proper conduct of their manufacturing processes. In these instances the refractories engineer's work is similar to a doctor's. He, through his mechanical, electrical and metallurgical knowledge, diagnoses the faulty practice, determines why this refractory lining, roof or bottom is failing to give the proper service and then describes the cure, watching carefully the selection of materials and seeing that they are properly placed in the furnace or whatever the apparatus is upon which he is working. This can be nicely illustrated by the experience of one of the industry's most competent refractories engineers a few months ago. A large copper refinery, of international importance, had been using a reverberatory fired by hand with coal thru the means of a Dutch Oven. The heat in the re-

[1] Refractories Division, St. Louis Meeting, Feb. 28, 1922.

verberatory was about 2600°F under this process. The bottom was of silica sand, the side walls of magnesite brick and the roof was laid up of heavy silica shapes making it twenty inches thick. This company found that by eliminating the Dutch Oven and by feeding powdered coal direct to the reverberatory they could make one furnace take the place of four as operated under the old practice and that they could perfect a saving of 28% of the fuel formerly consumed. The result was that instead of obtaining 2600°F in their furnace the temperature increased to about 3200°F and the heavy silica roofs quickly burned out. Furthermore where the silica bottom and the magnesia brick joined, the magnesia brick quickly disintegrated through the attack of the silica at the increased temperature, leaving an unsupported side wall, which was liable to fall at any time, and removing all lining protection where the magnesia brick had disintegrated. This was an experience which none of the old and tried employees of this particular smelting company had ever seen before and they were at a loss as to how to remedy it. Finally our friend the refractories engineer was called on the job, with the result that in a very short time he properly diagnosed the trouble and prescribed the cure, which was highly successful. Perhaps the "cure" might be interesting: A thinner roof was recommended, namely, one of 12″ shapes, thin enough to allow thorough radiation, the release of the intensified heat against the crown, therefore lengthening the life of the silica brick. A magnesite bottom was recommended and installed for metallurgical reasons and thereby the silica bottom, which had such a ruinous effect on the magnesite side walls, was done away with, and the disintegration of the magnesite brick stopped. The recommendation of the magnesite bottom, alone, saved this company an immense amount of money as a purer product resulted, entirely elimiating the use of the blast furnace later in the process. This is just one of a hundred or more cares of refractories engineering that has come to the writer's attention since he has been interested in this subject.

The constant demands made upon the metallurgical industry for a better product, the improvements in furnace construction, the high price of fuel, labor and equipment, all have tended to influence remodelling of old furnace equipment and the development of new and more efficient furnaces. This all means work for the refractories engineer as he is truly the court of last appeal when a radical change or a new furnace is perfected. It is as truly important that a lining be properly fitted to a furnace and process as it is that a potter produce a glaze that fits perfectly to his body or bisque. The advent of the electric furnace has probably had more to do with the development of the refractories engineer than any one type of furnace. Every now and then we hear of a new type being perfected or an old type being put to a new use, where a new lining must be installed. Rule of thumb methods are still, sad to say, being used in a great number of metallurgical and non-

metal producing plants where high grade refractories are used or abused. This method can not survive the demands which our present-day competition makes on the furnace user. Why line a cupola with expensive basic refractories when low priced fire-brick will even better answer the purpose, just because it has been the practice at this particular plant to do this? This is an actual condition which came under the writer's observation, and he leaves it to the reader to estimate the operating costs on this cupola. Are refractories engineers needed? Most emphatically yes. And the time will shortly arrive when more young ceramic engineers will enter this most important field.

Discussion

By A. F. Greaves-Walker.—Mr. Dornbach's paper brings out quite forcibly the need of the refractories industry for specially trained engineers. The colleges give an excellent opportunity for training such men, but it is, of course, more or less up to the men themselves to determine whether to take up this work and select their courses accordingly.

The particular requirements of a refractories engineer are a good ceramic training with special emphasis on refractories; a thorough knowledge of metallurgy and metallurgical furnace design; a good grounding in electrical engineering in order that pace may be kept with the rapidly developing electric furnace; a thorough knowledge of the principles of combustion, furnace design and fuels, and a good knowledge of geology. This latter is required because of the necessity of knowing the ores, fuel and raw materials with which the engineer has to deal.

In the past few years there has been a constant demand for men with this training in both the refractories and metallurgical industries, but there are no trained men available. It has even become necessary to have engineers on the sales forces of the refractories companies due to the demand of the consumer for salesmen who could diagnose his requirements and sell him the proper refractories.

With such an excellent opportunity for young men in a comparatively new field, it is hoped that more of our ceramic students will grasp it and take up the new work.

EXTENSION WORK[1]

By Paul E. Cox

ABSTRACT

The work in Engineering Extension at Iowa State College has been furthered by popular lectures supported by work on the potter's wheel, thereby getting before 40,000 members of Women's Clubs the fact that the ceramic profession is a vital factor in home life from many angles. It is shown how easily and cheaply such development work can be done.

In the late fall of 1920 Mrs. Lillian Crowley, Des Moines, Iowa, applied to the writer in behalf of the General Federation of Women's Clubs for

[1] Art Division, St. Louis Meeting, Feb. 28, 1922.

data for a paper to be printed in the Des Moines Register in the page devoted to things of interest to women. This came about for the reason that Iowa State College has a very large Home Economics Division and many of the young women come into the Department of Ceramics for training in pottery making, with the expectation, of course, that this work may prove of service to them in their teaching work later on. Mrs. Crowley became interested as is the case with most people in the work the writer happened to be doing on the wheel and an invitation was extended that brought about the extension work to be spoken of.

The writer built a potter's wheel of a special sort, so arranged that all the parts could be taken down and boxed up in the "crib" of the wheel, so that easy shipment could be had, the "crib" being the container for the rest of the machine. This makes a package of about 350 pounds and when the wheel is set up the machine is a rather rough-and-ready specimen of the old-fashioned kick wheel of the sort used by the country shops of stoneware pottery days. Clay is then carried along by the writer and with the few simple tools needed for such work it is possible to demonstrate the process of forming a vase in the rooms selected by the club women as a place for the show.

The first talk was in Des Moines under the patronage of the Fine Arts Association and this talk was repeated this year again. With the newspaper notices to suggest it, the Department of Engineering Extension head, Professor Faber, saw that a new activity was ready made for him and the writer has delivered from one to three talks a month all the year and has been compelled to refuse many other invitations, because of the fact that women can not readily put aside household cares on Saturdays and teachers have classes in the week days that interfere on their side with mid-week engagements. It is plain to be seen, however, that such work, properly handled, is easily a way to bring the knowledge of what ceramics folks are doing to a very large circle of people. In Iowa this work extends a knowledge of ceramics as an engineering profession to an organization consisting of 40,000 women, most of them mothers of sons and daughters who are potential students of ceramics or else potential consumers of the products of the ceramic arts and manufactures.

The wheel is sufficiently out of date so that it is a great attraction to nearly every person because it is no longer a familiar tool. With the wheel, a few lantern slides and a popular talk it is easy to hold an audience for two hours, and while no charge is made for the service, other than expenses, the writer has been gratified by the reports that come in about the interest shown, and by the desire to have this service in the several little cities of Iowa.

The talk deals not with art pottery but with pottery in general and from the standpoint of body composition and technical considerations generally.

Naturally the talk is reduced to simple terms, and is calculated to bring up the elderly lady with the heirloom with a question showing her pride in its possession. The real idea is to get before each group exactly what the field of ceramics covers, how to select dishes for the household use, and what the American and studio art potteries have to make the home more interesting. Out of this ought to grow benefit to the ceramic profession generally, as these women are the home makers of a commonwealth. And out of it ought to develop interest in the product of those interested in the Art Division, as every vase offered for sale will have more interest after common Iowa shale has been formed before them into pottery which can be handled and talked about with the maker. The pottery is brought to them instead of their visiting the pottery. And the shale chosen is one widely advertised as being used in a building block, so that mention of the source of the raw material brings home to them the lesson of what training can do with very simple material. Not yet has the writer failed to have to answer that water and Iowa shale made the mixture used.

The reaction on the Iowa State College is of less interest to those not of that institution but it has been found well worth while to have this work done and the authorities recognize the advertising value of this sort of thing. In token of this recognition the plan is being urged of the establishment of a studio pottery, with a competent artist doing the design work, who will use a part of the time to train others to make up a staff of several workers. This is decidedly an endorsement of what the Art Division is preaching, for this work is being initiated in the Engineering Division with the frank acknowledgment, or rather with the far-sightedness of a good administrator, that engineering and all other arts and sciences are mutually dependent one on the other, and that the young man or woman with a bent for crafts work needs direction and the chance to have it, whether it be to build a better looking machine or a better looking vase.

It would seem therefore that in every community similar extension work could be developed. The person is unwise who does not see the tremendous influence that women have in American life, for women are the great purchasing mass after all. Women can best be reached in the interests of ceramics as a profession, through the Art Division group. It is this idea therefore that prompts the writer to submit a paper hardly of a character to deserve attention in a body like the American Ceramic Society, otherwise. It should be noted, however, that few students enter any college unfamiliar with what the names "civil engineer" or "chemical engineer" or other engineering professions' names have to do but certainly out of the several hundreds entering Iowa State College each year there are few to whom the word "ceramics" has a meaning of any sort and a canvas of the membership of the Society would show a considerable number who had taken up the study of the profession because of having their curiosity excited by seeing

interesting work going on where that unfamiliar word was being used by a small but busy group of people. The extension work has been done cheaply and effectively and has reached directly and indirectly a wide circle of household managers. Teachers of art in high schools and colleges have been eager listeners and there is a great and real interest in exactly what the Art Division proposes to do. And this that the Art Division proposes to do will get before a great public what an influence the ceramist is to be and has always been in daily life. In other words the Art Division can very well be the publicity department of the American Ceramic Society so far as the lay people are concerned.

Department of Ceramics
Iowa State College
Ames, Iowa

ITEMS OF COST FREQUENTLY OVERLOOKED[1]

By F. T. Owens

There will be some of you who will no doubt wonder what particular items of cost there could be that are not included in your books and it is possible that none of you have these to contend with, but it is a matter of record that most manufacturers fail to consider some of the items that are causing serious losses and are often overlooked.

Many manufacturers are enjoying a false security because they do not keep an absolute record. For instance, in the manufacture of brick or hollow ware, a certain percentage is placed on the dryer cars without being recorded with the thought that this will take care of all breakage due to the drying and burning. Would it not be much better to have an absolute count, keeping a record of the breakage in dryer and kilns and find out just what the breakage is? For it is only by giving these matters due consideration and studying their importance that we endeavor to correct them.

Another source of loss comes in the lack of proper sense of proportion between costs and selling price, but before taking that up, it might be well to consider the question of costs from another standpoint. Assume that a machine production of 987,000 brick for the month is reported at a cost of $16,650.69. This is the machine production and shows us a cost of $16.87. However, we find a dryer breakage of 2%, a kiln breakage of 5%, which decreases the net production to the figures of 917,910 brick and increases the $16.87 cost to $18.47 per M. We find also that 10% of the production are seconds, which have to be sold at $2.00 less than the actual cost price, thus raising the cost of the first quality ware to $18.43, which is a net difference of $1.56 between the figures we first had and those we get finally.

On the first figures of $16.87 we would add sufficient to bring the selling

[1] Heavy Clay Products Division, St. Louis Meeting, Feb. 28, 1922.

price to $19.50. This would allow us a profit of 12.8%, but on the revised figures we find the profit is only 5½%.

In the figures quoted above there is nothing for idle time throughout the year and the manufacturer who sits down and figures the cost for one month and believes that he can sell for the succeeding ninety days on the basis of that first month's costs is seriously fooling himself.

What manufacturing business can afford to push ahead, put in improved methods and machines on a selling price of 12% above cost of production? The smallest margin that any manufacturer should consider should be 20%. In other words, if the unit of sale costs $16.00, then it should sell for $20.00, which allows that 20% of the selling price for profit above cost and I think that those of you who have been in the brick business will agree with me that a four dollar profit at the factory end is something we have rarely heard of, except in a few cases where a highly specialized brick is being considered. Aside from the war times, the hollow tile manufacturers and the common brick manufacturers have found themselves in a no more favorable situation.

A basis of costs figured on any one month's production can not show you the results unless continuous operation throughout the entire twelve months of the year can be had. There may be some who can have a clay plant idle without having any expense attached, but such a plant would be worth little when it was started up anew, for some one must be looking after it day by day or a very serious depreciation comes so that when it is time to start the plant heavy repair bills must be met. It is fair to assume that the average plant producing 120 tons of material per day has an overhead of approximately $1000 per month in interest charges, insurance, up-keep, watchman, heating, water, etc., and if such a plant is down for three months, then the overhead of those three months must be distributed throughout the cost the entire year. Unless this is done the manufacturer is going to find himself disappointed when the annual balance sheet is made up.

Depreciation must be given due consideration and if this is not done, after a term of years the manufacturer will find himself with a plant worth less than the representation in capital stock on his books. An item of depreciation is properly chargeable in your costs and should appear there. If this is not done, it can only mean a loss in the long run.

There is another item of cost which should have very careful attention and this is in the off-quality material. Some of you may not be troubled with this, but then again, others find it quite a problem. Assume for the moment that you are making a material on which you have determined your cost to be approximately $20 per unit, after giving consideration to your second quality ware and breakage. The experience in the past has been that, on a cost of $20, one dollar or one dollar and a half would be

plenty to add for profit. Now let us see what happens. In the production of a million of first-quality ware we get 200,000 that are off shade or off quality so that the unit price drops to $18 per M. This means a two dollar loss or $400, which must be considered in the selling price of the strictly first-class ware, or a matter of $.50 per unit. This point has been missed in the past and is being missed by a great many manufacturers today and accounts, in many instances, for the disappointment of the Board of Directors when they consider the profits for the year and find that instead of a 10% dividend they can only make it three or four.

At this point it might be well to consider another problem that faces us today. The indications are that the next five years will see some wonderful developments in the manufacture of heavy clay wares and it is not beyond the realm of possibility that many of the plants in service today will be out of date five years hence. This brings to our minds the thought, should we not provide for obsolescence as well as depreciation? Assume that a plant stands at $100,000 today and that thirty thousand of this investment will become obsolete in five years. Should we not make provisions to take care of this? Otherwise, how will the improvement be paid for when it must be put in? We would find serious difficulty in providing for this day under our present income tax law and it is a serious problem that should have our careful consideration and be brought to the attention of those who can afford us relief.

We have heard a great deal about deflation and the reduction of living costs, etc., but those of us who have had to travel much during the last year have found, in many instances, costs have not receded any from the war time rates and we naturally wonder why. If you will give consideration to the following thought, we believe you will see why. We have in this country two large strings of hotels. With one of these it is the purpose of the managing board to build one new hotel each year from the profits of the others and as such a hotel costs today about $2,000,000 fully equipped, you can see that in order to have $2,000,000 net gain over dividends to put in a new enterprise they must pay our good old Uncle Sam a handsome income tax. To do this they are taking it from the man who finds it necessary to travel from point to point to earn his daily bread. If you have figured out on your plant that thirty thousand dollars made in 1922 will afford the return on the capital invested that you think is adequate, are you figuring to earn enough for Uncle Sam so that you may be allowed to pay the desired amount to your stockholders? If not, you had better give this consideration, else you will find when you come to make up your balance sheet that the profits have again vanished.

Some time ago the writer had occasion to check up some figures on a plant to see why burning costs had suddenly risen and after a careful comparison was made of a number of kiln records, it was found that nearly

10% less ware was being placed in the kilns than had formerly been done, with a consequent sharp rise in burning costs.

It is only by keeping very careful records and then checking the records of one period against those of another that we can find the reason for rising costs and a careful analysis should be made at all times of the costs as they are shown from time to time so that occurrences, such as we have noted, may be quickly brought to light and corrected.

If we could imbue the employees with the thought that they are working with the material, which while only raw clay to start with, has added to it gold in the shape of labor as it goes from process to process, they might consider it from a different standpoint and use more care in its handling and take more pride in seeing that the final result is that which is hoped for.

We must get our men away from the thought of being ordinary mud mixers and get them to see, if possible, that working in clay to produce hollow ware, floor tile, roofing tile, face brick, common brick or any similar ware is just as honorable as the production of the finest chinas or glass ware.

In closing allow me to urge upon you the adoption of uniform cost system with your fellow manufacturers so that when you come to compare costs (and this I urge upon you most strongly), you will be talking about the same thing in exactly the same way and when the golden day arrives that we can sit down and talk about our costs, each of us talking on about the same basis, then indeed we will be making a greater progress than has been shown heretofore.

NOTES ON GREEN STAINING OF CLAY WARE[1]

By C. W. Hill

The cause of yellow-green staining which sometimes occurs on ceramic products on exposure to weather has usually been attributed to compounds of vanadium. The explanation probably had its origin in the investigations of Seger who appears to have established the presence of vanadium in the material examined by him. The view has been perpetuated in the literature by several American and English ceramists and is that of nearly all the ceramists with whom the subject has been discussed.

A case was brought to the writer's attention several years ago of green stain on ware made from clay which was known to contain a small amount of pyrites. A sample of the stain was digested with various acids but the solution failed to give a test for iron. The dried stain was fused with an alkali and the fusion dissolved in hydrochloric acid. This solution gave a heavy iron test. Upon neutralization with ammonia a white flocculent precipitate was obtained, indicating that the iron had been combined with alumina or silica.

[1] Terra Cotta Division, St. Louis Meeting, Feb. 28, 1922.

This test has since been repeated with a positive test for iron whenever examples of green staining could be found.

The stain is dissolved by oxalic acid solution or by a solution of alum acidified by sulphuric acid, the latter having been brought to our attention by Mr. George Facht. Either of these solutions if sufficiently concentrated gives an iron test.

The tendency toward green staining is present in buff burning clays, which burn "soft," that is, have a high absorption. We understand that manufacturers of buff face brick overcame the difficulty either by burning at a higher temperature or by addition of a tighter burning clay. Whether the first remedy is due entirely to the decreased absorption of the product with decreased leaching action of water or in part due to the fixation of the iron in a less soluble compound, we are not prepared to say. The point is doubtless one of theoretical interest and not of practical value. When the ware is covered with a slip the green staining may be avoided by use of a "hard" slip, without resorting to higher burning.

The absence of iron in Seger's analysis as well as certain differences in chemical behavior and appearance of the stain he describes would indicate that this was of a different nature than the stains we have investigated. Our experience, however, would indicate the desirability of testing for iron by fusion before assuming that vanadium is the cause of any green stain. We are inclined to believe that with Eastern and Central clays the stain is probably entirely due to iron. We have not tested the stain on Western clays which may possibly contain vanadium and resemble the clay tested by Seger.

DISCUSSIONS OF "THE ADAPTABILITY OF THE GAS FIRED COMPARTMENT KILN FOR THE BURNING OF CLAY PRODUCTS"[1]

By C. B. Harrop:—Mr. Richardson is advocating the use of a kiln which, under certain conditions and for certain wares, is a very desirable type and is surely going to be installed for white wares in the near future.

Provided the initial investment is not prohibitive, a fuel saving of over 50 per cent will enable the owner of this kiln to show the stockholders a neat increase in annual profits or else it will enable him to cut the price of this product to a point that will be of very serious concern to his less progressive competitor.

The author calls attention to the fact that when describing the performance of the car tunnel kiln, "comparisons have always been made with the old periodic kiln and not with the latest developed continuous kilns of other types." He then proceeds to compare the performance of the compartment kiln, which he is advocating, with the same "old periodic kiln."

[1] Richardson, *Jour. Am. Ceram. Soc.*, **5**, 254 (1922).

Personally, I feel that a comparison of either type of continuous kiln with the periodic kiln is perfectly justifiable, for it is this wasteful kiln that we are all anxious to see supplanted with a modern and more economical structure. As a matter of fact, I doubt if there is a clayworking plant in the United States where both the moving-fire-zone continuous kiln and the car tunnel kiln can be found, while almost invariably are there periodic kilns at the same plant with either type of continuous kiln. If we compare both types of continuous kiln with the periodic kiln, we can readily compare the performance of the two continuous kilns with each other.

The author states that the continuous compartment kiln for heavy wares operating on the same yard with periodic kilns has shown a fuel saving of *more than 50 per cent.* This is a saving that should attract the attention of every progressive manufacturer. However, it should be mentioned here that on a number of car tunnel kiln installations handling white wares, the fuel saving, over former periodic kiln operation, is 75 per cent and even higher in some instances.

Under No. 4 of the author's summary, he states that in a car tunnel kiln, the capacity is limited because a "strong draft does not distribute the heat properly." I do not believe that he is justified in making this statement, as the writer can exhibit several installations of the car tunnel kiln, operating at high production, in which the temperature variations over the cross-section of the ware are practically nil.

The author makes the statement that repairs can be made more readily in the compartment kiln than in the car tunnel kiln. It should be pointed out in this connection that, as the temperature in any part of the tunnel kiln is held practically constant at all times, expansion and contraction trouble are conspicuous by their absence. The car platforms are the only parts to suffer from this action, which is so prevalent in periodic and moving-fire-zone continuous kilns and they are attended to on the outside and interfere in no way with the operation of the kiln.

The author does not allude to the cost of installing a compartment continuous kiln. Figures on the cost of this kiln for a given capacity would be very interesting and valuable for comparison purposes.

By A. F. Greaves-Walker:—There can be little question but that it has been amply demonstrated that the gas fired compartment kiln can successfully replace the present types of periodic kilns used in any branch of the industry with an assured saving of at least 50% in the cost of operation.

Many kilns of this type have been built in this country for use in burning heavy clay products, the majority of which are or have been successfully operated. Failures or partial failure or the failure to come up to expectations have been due, in every case the writer has investigated, to poor construction or failure to follow good engineering practice.

There is a great question as to whether the railroad tunnel kiln will ever come into general use in the heavy clay products industry due to the obvious limits on the capacity and the space required for installation. In this branch the continuous kiln is, at present, the only solution of the burning problem.

However, it is the writer's opinion that the railroad tunnel kiln has demonstrated that it is the ideal type for the pottery industry and while the continuous compartment type may be used in isolated instances, it will never become popular.

DISCUSSION OF "PHYSICAL DEFECTS IN TANK BLOCKS"[1]

By W. Angus McIntyre:—Fig. 1. Two sets of trend lines are seen. The diagonal ones correspond to the laminations and the less permanent horizontal set is found only toward the sides of the block.

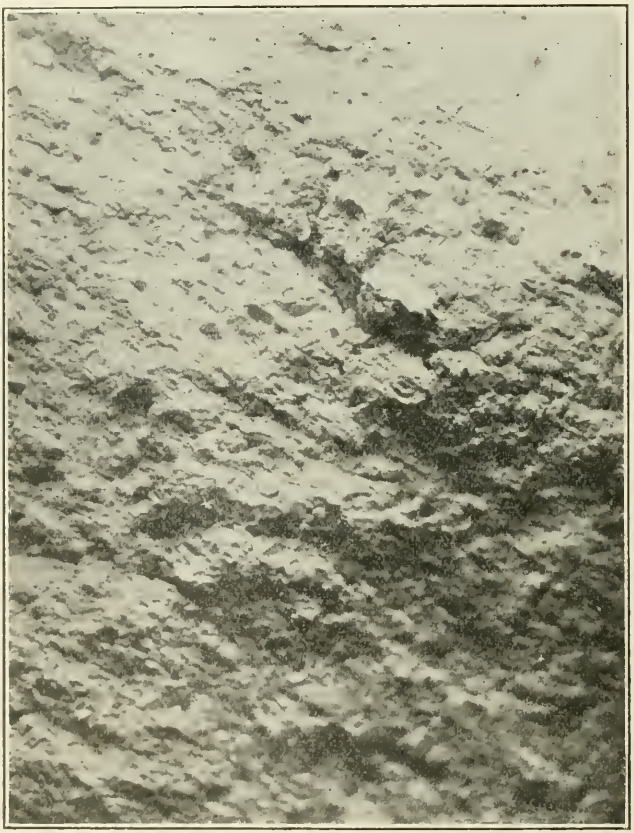

Fig. 1.

[1] Loomis, *Jour. Am. Ceram. Soc.*, **5**, 102 (1922).

FIG. 2.

FIG. 3.

Fig. 2 is typical of most of the blocks I have examined. In addition to several cavities and numerous pinholes irregularly arranged there are concentric laminations which gradually flatten out toward the top and for the last $^3/_8$" become quite horizontal when enlarged up to 3–4 diameters.

Fig. 3 is a fragment of a block which has stood up fairly well in practice. In this the pinholes and cavities are just as numerous as in the previous

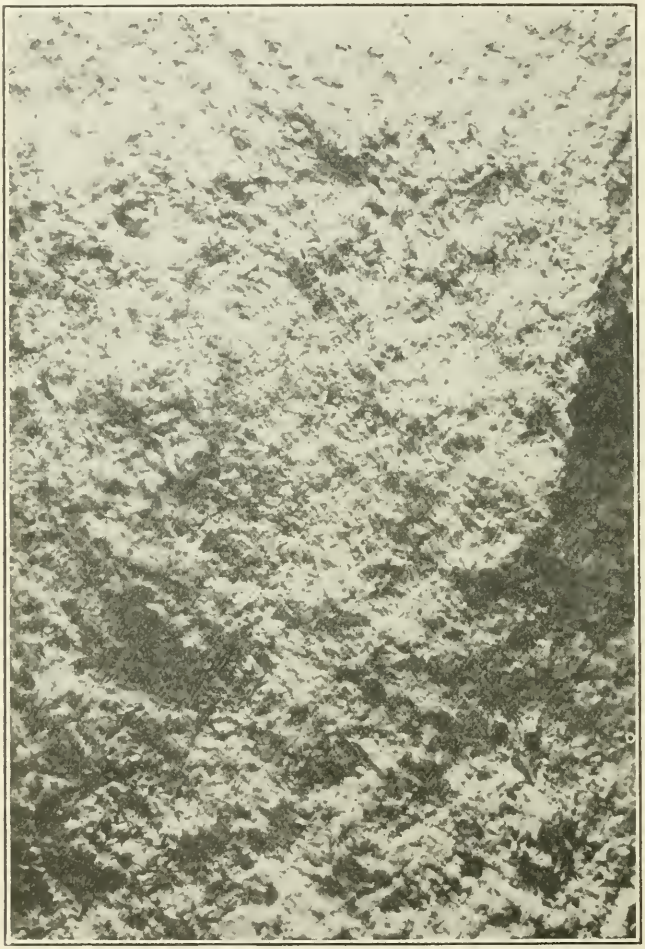

Fig. 4.

specimen, but even on enlarging only one set of trend lines can be seen and they bear no apparent relationship to the edges of the block.

In attempting to prepare microscopic sections of these blocks it was found that the specimens tend to fracture much more readily in the direction of these various trend lines and the structure appears to persist throughout the blocks down to a very fine scale.

BULLETIN

of the

American Ceramic Society

A Monthly Publication Devoted to Proceedings of the Society, Discussions of Plant Problems, Discussions of Technical and Scientific Questions and Promotion of Coöperative Research

Edited by the Secretary of the Society Assisted by Officers of the Industrial Divisions

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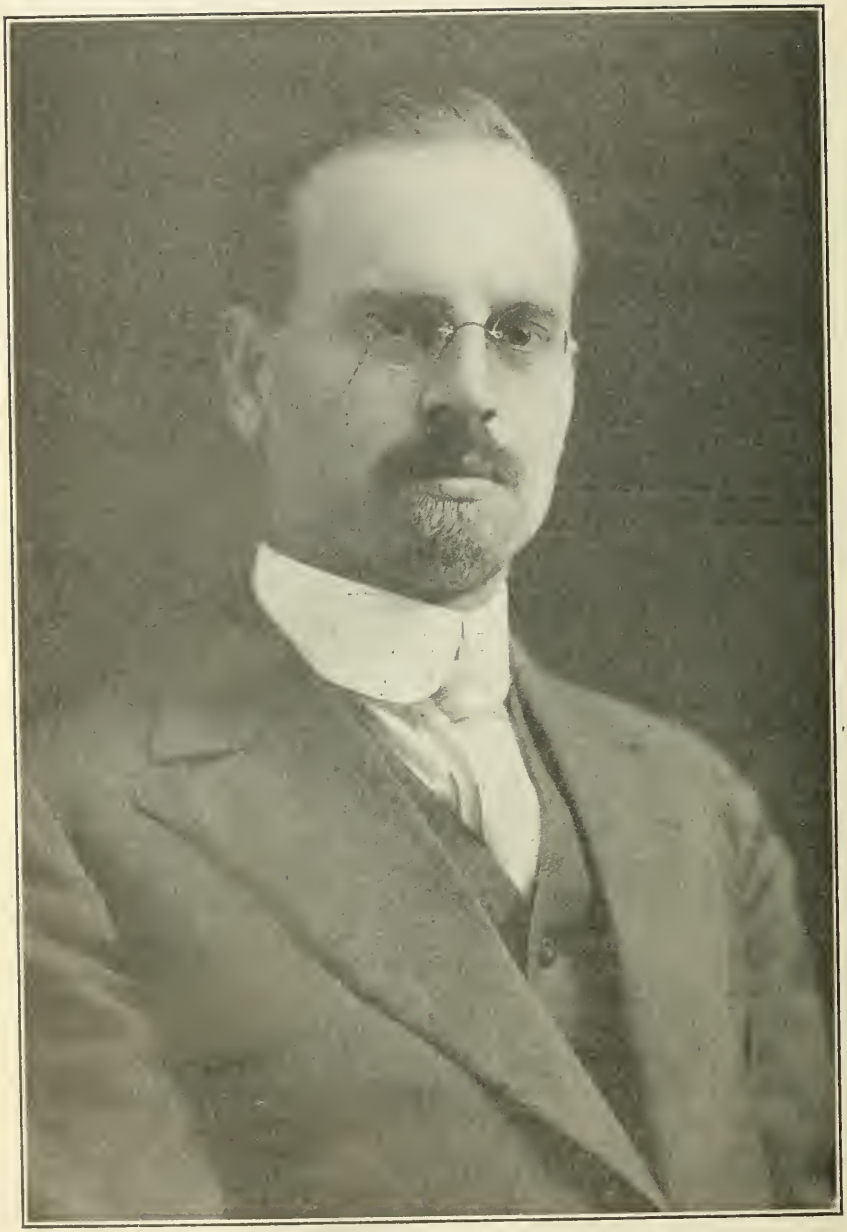
Vol. 1 July, 1922 No. 3

EDITORIALS

DR. EDWARD W. WASHBURN

A Sketch and a Tribute

For six years Dr. E. W. Washburn has been the directing head of the department of Ceramic Engineering at the University of Illinois and during the past year he has been editor-in-chief of the *Journal of the American Ceramic Society.* During these six years he has contributed to ceramic science from the viewpoint of a physical chemist with a peculiar gift for searching and proving fundamentals. His laboratory at the University is equipped with devices that are unusual to ceramic laboratories but the discoveries there made have been told by Dr. Washburn in such an elementary fashion that most of us have not an adequate appreciation of the ingenious methods and painstaking thoroughness by which he has derived fundamental facts, concerning which ceramists have long been theorizing from empirical observations. One must study his contributions and know something of the methods used to appreciate the value of that which Dr. Washburn has contributed during these six years. Only thus can an estimate be made of the loss which ceramic science will feel because of his withdrawal from this special field. His new work takes him to Washington, D. C., where he will be editor-in-chief of "International Critical Tables of Physical, Chemical, and Engineering Constants," and chairman of the Division of Chemistry and Chemical Technology of the National Research Council.



E. W. Washburn

The present editor of this *Journal* confidently expresses for all members of the Society sincere gratitude to Dr. Washburn for his contributions to ceramic science and especially for the services he efficiently rendered as member of the Research Committee during the past four years and as editor of this *Journal* during 1921. It is hoped that the Society will be favored by a continuance of his interest and assistance in the things it aims to accomplish. He enters into a broader field of science with the best wishes of every member of this Society.

We recite here from "Who's Who" a résumé of what he has achieved: Chemist: Univ. of Nebr., 1899–1901; Mass. Inst. Tech., B.S. 1905, Ph.D. 1908; Research assoc. in physical chemistry, Mass. Inst. Tech., 1906–08; Assoc. in chem., 1908–10, Assist. prof., 1910–13; Prof. physical chem., 1913–16; Prof. ceramic chem., and head of dept. of ceramic engineering, 1916–22; U. of Ill. Editor-in-chief Internat. Critical Tables of Phys., Chem. and Engrng. Constants, 1922—Vice-chmn. and acting chmn., 1918–19 Chmn. 1922–23, Div. of chem. and chem. tech., Natl. Research Council; Delegate to Internat. Union Pure and Appl. Chem., London, 1919, Lyons, 1922 and to Internat. Research Council, Brussels, 1919 and 1922; Amer. Commissioner Internat. Annual Tables of Phys. and Chem. Constants, 1921. Fel. A.A.A.S., Mem. Am. Chem. Soc., Am. Phys. Soc., Am. Ceramic Soc. (Ed. "Jour." 1921), Nat. Research Council, Soc. Glass Technology, Roy. Soc. Arts; Ill. Acad. Sci., Phi Lambda Upsilon, Sigma Xi, Mass. Soc. Mayflower Des., Colonial Families. *Author:* Introduction to the Principles of Physical Chemistry, McGraw-Hill Book Co., New York, 1915, 2nd. Ed. 1921, French translation by Noyes and Weiss, Payot et Cie, Paris, 1922; sixty contributions to scientific and technical press embodying results of original research. *Clubs:* Cosmos, Washington, D. C., Chemists, N. Y., University, Urbana, Ill. *Address:* National Research Council, Washington, D. C.

His researches and publications are:

A. Introduction to the Principles of Physical Chemistry.

The McGraw-Hill Book Co., New York. 1915. Pp. xxv + 445. 2nd. Edition 1921. Pp. xxvii + 500.

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67. The Surface Tensions of the Soda-Lime-Silica Glasses at High Temperatures. (With E. E. Libman.)

68. The Densities of the Soda-Lime-Silica Glasses at High Temperatures. (With S. H. Li.)

69. The Products of the Calcination of Flint and Chalcedony. (With L. Navias.)

TWO NOTABLE EVENTS MARK PROGRESS IN CERAMIC ENGINEERING

Edward Orton, Jr. Made Doctor of Science

New Jersey Ceramic Research Station Building Dedicated

Rutgers College honored itself and gave recognition to Ceramic Engineering as an applied science when on June 13th it conferred the degree of Doctor of Science upon Edward Orton, Jr. and dedicated a handsome and well-equipped building to the teaching of, and for, research in Ceramics.

For over 150 years Rutgers College has maintained an enviable research record in the classics and in the pure sciences and no deviation was made from her traditional conservatism when she in this substantial manner recognized Ceramics as a science.

Prof. George H. Brown.

For twenty years Rutgers College has been offering courses of instruction in Ceramics and maintaining ceramic research laboratories. These twenty years have been years of substantial accomplishments in Ceramic technology and of increasing recognition and support of scientific and technical research by the Ceramic industries.

In 1894 the first collegiate course of instruction in Ceramic Engineering was opened to students at the Ohio State University under the directorship of Edward Orton, Jr. Four years later the American Ceramic Society was organized by him. In rapid succession similar courses of ceramic instruction and ceramic research stations were established in the states of New York, New Jersey,

Illinois, Iowa, Oregon, North Dakota, Washington and in Saskatoon, Canada, in federal bureaus, and in several European countries. Societies for the promotion of Ceramic arts and sciences have been established in England, France, Germany and Japan. The Dean of this world-wide organization for the promotion of ceramic arts and sciences is our own Edward Orton, Jr., who for twenty years was secretary of the American

Edward Orton, Jr., E.M., D.S.

Albert V. Bleininger.

Ceramic Society. It was very fitting, therefore, that Rutgers College with its 150 years of traditions should, on the 20th anniversary of the establishing of its own ceramic department, give recognition and honor to him to whom belongs the credit for initiating this world-wide promotion of Ceramic technology and science.

Left to right: Abel Hansen, Charles H. Cook, Frank H. Riddle, Dr. W. H. S. Demarest, Prof. George H. Brown, Roy H. Minton.

Prof. George H. Brown is the Director of the New Jersey Ceramic Research Station. To him belongs the lion's share of credit for obtaining the handsome and well appointed building on Rutgers campus. He was loyally supported by the New Jersey Clay Workers under the

Charles A. Bloomfield. Dr. Edward Orton, Jr.

leadership of Charles A. Bloomfield, Charles H. Cook, Abel Hansen, August Staudt, past presidents of the New Jersey Clay Workers Association, and by Roy H. Minton, the present president. $100,000 was given by the State and the equivalent of $30,000 was contributed by the clay workers.

The purposes of this Ceramic Research Station are:

1. To give instruction in Ceramic Engineering and in Ceramic Arts and Sciences.
2. To conduct Extension Courses in Ceramics in different centers throughout the State.
3. To Conduct Coöperative Industrial Researches.
4. To investigate the resources of the State ceramic materials.
5. To publish Ceramic literature.

We confidently bespeak for the Ceramic workers the world around a self-congratulation that the State of New Jersey has so well equipped herself for the training of ceramists and for the prosecution of ceramic investigations. These facilities, though they will be maintained by New Jersey, will be an addition to the facilities of the entire ceramic craft the world around.

THE VALUE OF DISCUSSIONS

Growth: the Interchange of Ideas.—Since the founding of the American Ceramic Society the custom of the Annual Meetings has been to carry on the activities of the Society through the medium of *Discussions.* The need for this interchange of ideas was, in fact, the fundamental reason for the organization of the Society. If everyone had felt complete master of his work, with no difficulties to encounter and no problems to solve, each would have continued to go his separate way content. There would have been no desire for lengthy trips which meant time lost and money and energy expended. And in the end this narrow, ingrowing spirit would have meant a retrogression and serious crippling of business. *Isolation does not encourage progress.*

The reason, then, for these meetings was the need felt by the scientific man and the practical business man to get together and contribute to the experience of others as well as to accept their share. Each one recognized his limitations and sensed the value of the ideas of the others. This interchange of ideas has always stood for growth and in the Society it meant development from a few score of men to many hundreds.

Thoroughness of the Early Years.—But with the increase in membership in the Society new difficulties arose. In the early days, when the number was small, the men knew each other intimately and their problems took on the aspect of personal difficulties. Each one was considered at length and thoroughly discussed. In the older volumes of the *Transactions,* all of the members were active participants in these discussions. They were intimate and companionable, and yet, informal as they were, the results were far-reaching and conclusive. A problem was not left until the solution was made as complete as these men could work it out.

If a definite end could not be obtained, the discussions were continued throughout the year by correspondence and the questions were reconsidered at the next Annual Meeting. Thoroughness characterizes these discussions as they appear now in the *Transactions*.

Discussions Supplement Annual Meeting.—Necessarily, with the remarkable increase in the Society membership, the attendance at the meetings has become a matter of hundreds rather than the few score as at first. The affairs of the Society demand more time; there are more problems, but no more time. One of the most frequent expressions during the progress of a heated discussion is "This must be continued at another time." There are many other papers to be heard; many other questions of just as vital importance to be taken up and probably left unfinished. And then the meeting is over. A few copies of the Reports are circulated among the officers. Otherwise, the questions discussed are dead issues, the solutions of problems lost.

This, then, is the first purpose of opening the pages of the *Bulletin* to the members for Discussions. There is the opportunity of preserving the record of the results of the meetings as well as carrying the subject much further and working out new phases and solutions. Objections may be brought up and confusing questions explained. In other words, the meeting is over, but the forum is once more open and Discussions are going full tilt.

Open Forum for the Society.—A second, but by no means less, consideration is the matter of the thousand or more members who have not been present at the meeting. They have as many problems of vital importance to work out and as many ideas of worth to offer to others but without a medium of expression their aid is impossible. With the presentation of the Discussions they are not only given the benefit of the transactions which they have missed, but they are invited to contribute to these same Discussions; to add their weight of experience. Not only to themselves but to the entire Society, these members take on a new significance for they are contributing to the welfare of the Society as well as deriving benefits from its organization. For the first time, the bulk of the Society is made to feel an active interest which hitherto has been denied. They recreated themselves into an active, working force which is ready to offer to the Society aid to the uttermost limit.

Keeps Subjects Active.—In addition to papers presented at the meetings and the discussions which follow them, there are many papers published which are received in the Editor's office not in connection with a meeting. These papers are vital and alive. Their problems and issues are current and as essential as any given consideration at the meetings. The members are losing a great deal not to use these for Discussions. The idea that a paper which was published last year is a dead issue is

fundamentally wrong. The *Journals* themselves are of more than current interest. Their scope includes subjects of interest to every member. They are current and alive until a new idea is presented to displace them.

Vitality of Discussions.—And so the *Bulletin* herewith presents the opportunity for this exchange of ideas. It is the organ of expression for the fifteen hundred members of the Society. A few score of men write the original papers which interest and demand the criticism of the entire Society. And it is in the *Bulletin* that these new voices must be heard. The *Bulletin* belongs to these fifteen hundred members in the seven Divisions, and it will become the thing they decree it to be. This is every member's opportunity to express ideas and ask questions.

The *Bulletin* will then be vital.

ACTIVITIES OF THE SOCIETY

U. S. Bureau of Mines

Laboratory Car "Holmes"

The accompanying illustration shows the gang of good men and true whose duty it is to keep the "Holmes" fires burning. The car is being used to visit different brick plants in the general region of Ohio for the observation of firing methods employed and the pointing out of wasteful practices and opportunities for improvement that should

Experimental Laboratory on the "Holmes."

Crew of Laboratory Car "Holmes," U. S. Bureau of Mines. Reading from left to right: Wm. Rice, A. R. Mumford, P. S. Bachman, Robt. Lunger, E. B. Baker, R. C. Zehm.

result in the saving of fuel. Results of tests made at a brick plant in St. Louis, recently visited, show a decided saving in fuel and an improved product. At South Park, Kentucky, after preliminary burns in a type of kiln for burning hollow tile, the car superintendent was able to point out needed changes in construction and operation that should result in a decided saving of fuel and an improved product.

Ceramic Experiment Station, Columbus, Ohio

Oxidation of Ceramic Wares during Firing

It is planned in the investigation of the oxidation of ceramic wares during firing, to continue making measurements of the rate of evolution of H_2O, CO_2, SO_3, and SO_2 from clay bars (Lower Kittaning fire) in a combustion tube in a current of oxygen at various temperatures, atmospheres and typical clays. During the oxidation of "siderite" iron clays, siderite, magnetite and hematite are, at a certain stage of the burn, all present at the same time.

Georgia Clays and Bauxites

Washing tests of Georgia clays have been completed. Samples of bauxitic and refractory clays have been calcined to cone 13, ground to pass 10 mesh and mixed with 40 per cent raw clay. Samples of commercial size bricks have been completed by the dry process. When made up into a standard pottery body this clay showed none of the objectional specks common to unwashed Georgia clays and was a good color.

Dolomite Investigations

Slacking tests have been run by the Bureau of Mines on clay-dolomite, bauxite-dolomite bricks previously burned. Different dolomites are being investigated as to mechanical and chemical desirability. The highly crystalline ore has been found to crush more readily than the dense.

New Members Received during May

Associate

Allison, John H., 902 Oliver Bldg., Pittsburgh, Pa., Sales Engineer, E. J. Deckman Co.
Bowers, John, 1510 Brunswick Ave., Trenton, N. J., B. O. T. Mfg. Co.
Curry, Earl, Willoughby, Ohio, Student, Ohio State University.
Donnenwirth, Arthur L., 121 S. Spring St., Bucyrus, Ohio, Student, Ohio State University
Green, Thomas S., La Courneuve, Seine, France, Cie des Meules Norton
Kane, Edward, 1432 Riverside Drive, Trenton, N. J.
Kennedye, C. Benton, 2085 Railway Exchange Bldg., St. Louis, Mo., District Manager, Brown Instrument Co.
Parsons, F. C., Atlantic Terra Cotta Co., Tottenville, N. Y., Supt.
Roberts, Nathaniel J., Quakerstown, Pa, Gen. Mgr., Quakerstown Stove Works
Rose, Charles I., 3802 Castleman St., St. Louis, Mo., Student, University of Illinois
Schweiker, Malcolm A., 137 W. 25th St., New York City, Gen. Mgr., Empire Floor and Wall Tile Co., Inc.
Thorpe, Drew M., 1922 Oliver Bldg., Pittsburgh, Pa., District Manager, E. J. Lavino & Co.
Tokunaga, Zenshiro, 2 Chome, Yorikunachi, Osaka, Japan

Corporation

Livermore Fire Brick Works, 604 Mission St., San Francisco, Cal.
J. L. Mott Co., Trenton, N. J.

The National China Co., Salineville, Ohio
Robertson Art Tile Co., Box 848, Trenton, N. J.
St. Louis Terra Cotta Co., 5811 Manchester Ave., St. Louis, Mo.

Batter Up!

In personal memberships this month we have held our own—thirteen—(an unlucky number to stick at), but in Corporation memberships we have taken a sickening drop. Optimistic as ever, though, we have an encouraging point to bring out. Seven of the Associates and four of the Corporations came in during the last three days. We expect now to have a batting average of four a day for the next month.

Bowman 2nd and Hottinger head the batting list with two Corporation members each. Babcock, Burroughs, and Watts have two Associate members each, and Salisbury has added another to his list of Corporation members. Those who put the leather across the plate once are Christopher, Hursh, Ichijo, Klinefelter, Malm, Ogden, and Wells. This shows that some of our bush-league players are giving the old guard a chance to wonder whether they can hold their places on the team.

Here is a typical letter from a typical worker:—

"Mr. Ross C. Purdy, *Secretary*
American Ceramic Society
Lord Hall, Ohio State University
Columbus, Ohio

Dear Sir:—

Will you kindly send to Mr.————, Chemist and Metallurgist of————, a sample *Journal*, descriptive literature of the Society, and an application blank. He is interested in fire clay refractories and I would appreciate it if you would send him a *Journal* containing an article on this subject.

Yours fraternally,
(Signed)————"

We have had a letter of this kind from the same man at least twice a month since he joined the Society about a year ago. Most of these "prospects" become members and boosters in their turn.

The Membership Committee are getting into their new uniforms. O. O. Bowman 2nd, the chairman, has a beautiful wind-up, the plate has been dusted off—now get into the game!

An Umpirical Correction

The score-card of the membership game, "Play Ball," reported in the May number, was slightly balled up and off its base, as it failed to give credit to Sam Geijsbeek for two more hits, making three in all and putting him in Class 2 of the pill-pounders. Having been properly cushioned, the umpire hastens to make this announcement, with due apologies.

Geographically Speaking

The geographical distribution of the *Journal* has been the subject of study lately, and the figures compiled are given below:—

Alabama	1	Connecticut	4	Florida	1
California	55	Delaware	2	Georgia	10
Colorado	12	District of Columbia	33	Idaho	1

Illinois	146	New Jersey	160	Washington	16
Indiana	47	New York	187	West Virginia	42
Iowa	17	New Mexico	1	Wisconsin	14
Kansas	7	North Carolina	5	Wyoming	1
Kentucky	13	North Dakota	2		
Louisiana	1	Ohio	319		
Maine	2	Oklahoma	3	Australia	8
Maryland	30	Oregon	8	Canada	38
Massachusetts	40	Pennsylvania	237	England	63
Michigan	37	Rhode Island	3	France	13
Minnesota	5	South Dakota	2	Philippines	1
Mississippi	1	Tennessee	11	Scotland	7
Missouri	78	Texas	8	Japan	74
Montana	2	Utah	4	Miscellaneous Foreign	69
Nebraska	1	Virginia	3		

Total 1845

As was to be expected, Ohio has the largest number of subscribers, with Pennsylvania as the runner-up. New York, New Jersey and Illinois are not far apart, but the rest of the states are not even on the same lap. Missourians have to be shown, of course, but surely seventy-eight is not adequate representation, and are there only four progressive ceramists in Connecticut?

Who's Where in the American Ceramic Society?

W. J. Bidleman has moved from Wellsville, Mo., to Denver, Colo., where his address is 12 Meade Apts., 200 Broadway.

H. D. Callahan of Columbus, Ohio, has taken a position with the National Fire Proofing Co. and is at present located at Port Murray, N. J.

George W. Cooper, publisher of "Glass Industry," has notified us of a change in the location of his office from 19 Liberty St. to 50 Church St., New York City.

S. F. Cox, of the Pittsburgh Plate Glass Co., has moved from Creighton, Pa., to 628 Haverhill St., Wilkinsburg, Pa.

E. E. Fisher, formerly of the Modern Glass Co., Toledo, Ohio, is now in the feldspar business at Hayesville, N. C.

R. D. T. Hollowell, secretary of the American Face Brick Association, may now be found at 130 North Wells St., Chicago, Ill., the new headquarters of the Association.

Lloyd Lamborn, editor of "Chemical Age," announces the removal of his office from East 28th Street to 381 Fourth Avenue, New York City.

Paul D. Merica, of the International Nickel Co., has changed his headquarters from Bayonne, N. J., to 67 Wall St., New York City.

Amos P. Potts, formerly with the Seguin Brick and Tile Co., at McQueeney, Texas, is now with the Clay Products Co., at Brazil, Ind.

G. R. Shelton, research fellow for the Corning Glass Works, has been transferred from the University of Illinois to the University of Saskatchewan, Saskatoon, Canada.

S. F. Walton has recently become a member of the firm of the Northern Refractories Co. at Ridgway, Pa., dealers in high grade crude and ground Pennsylvania fire clay.

Calendar of Conventions

American Association for the Advancement of Science—Salt Lake City, Utah, June 22–24, 1922

American Society for Testing Materials—Atlantic City, N. J., June 26–July 1, 1922, C. L. Warwick, Sec., 1315 Spruce St., Philadelphia, Pa.

International Union of Pure and Applied Chemistry—Lyons, France, June 27–30, 1922

National Bottle Manufacturers Association—July, 1922, C. R. Stevenson, Bus. Mgr., 120 Broadway, New York City

Annual Safety Congress of the National Safety Council—Detroit, Mich., August 28–September 1, 1922

American Chemical Society—Pittsburgh, Pa., Sept. 5–9, 1922, Charles L. Parsons, Sec., Washington, D. C.

Association of Iron and Steel Electrical Engineers—Cleveland, Ohio, September 11–15, 1922, John F. Kelly, Sec., Empire Bldg., Pittsburgh, Pa.

Eighth National Exposition of Chemical Industries—New York City, September 11–16, 1922

American Electrochemical Society—Montreal, Canada, September 21–23, 1922

National Association of Commercial Organization Secretaries—Chicago, Ill., October 23–25, 1922, John E. Northway, Sec., Hamilton, Ohio

National Exposition of Power and Mechanical Engineering—New York City, December 7–13, 1922

American Malleable Castings Association—January 10, 1923, Robt. E. Bolt, Sec., 1900 Euclid Bldg., Cleveland, Ohio

National Jewelers Board of Trade—New York City, January 18, 1923, F. C. Backus, Sec., 15 Maiden Lane, New York City

American Concrete Institute—February, 1923, Harvey Whipple, Sec., East Grand Boulevard at Moran, Detroit, Mich.

American Ceramic Society—Pittsburgh, Pa., February 12–17, 1923, Ross C. Purdy Sec., Columbus, Ohio

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Report of the Enamel Division

The fourth annual meeting of the Enamel Division of the American Ceramic Society was held at St. Louis, Mo., February 28 to March 3, in conjunction with the annual convention of the Society. There were 87 members of the Division present, a record attendance. Sixteen papers were read before the Division. These will appear in the *Journal of the American Ceramic Society* during the year. Editor Purdy has arranged for the publication of discussions by any member of the Division interested, and additional information in connection with the various papers will thus be brought out. All written discussions on the subjects of the papers will be welcomed by the Editor.

The following officers were elected for the present year:

Chairman—B. T. Sweely, Coonley Mfg. Co., Cicero, Ill.

Secretary—R. R. Danielson, Bureau of Standards, Washington, D. C.

Councilors—D. F. Riess, Vollrath Co., Sheboygan, Wis.
W. C. Lindemann, A. J. Lindemann & Hoverson Co., Milwaukee, Wis.
R. D. Landrum, Vitreous Enameling Co., Cleveland, Ohio
H. F. Staley, Metal & Thermit Corp., New York City

The following committees have been appointed for the year:

Standardization of Tests—E. P. Poste, *Chairman*, R. D. Cooke, H. N. Cox, L. J. Frost

Standardization of Products—D. F. Riess, *Chairman*, R. D. Cooke, C. A. Blackburn, B. T. Sweely

Membership—W. C. Lindemann, *Chairman*, C. M. Smoot, F. G. Jaeger, R. D. Landrum, E. E. Geisinger, H. N. Cox

Rules—J. B. Shaw, *Chairman*, R. D. Wells, B. A. Rice

Data—R. R. Danielson, *Chairman*, E. P. Poste, H. F. Staley, H. P. Reinecker

Research (Sheet Iron and Steel)—R. R. Danielson, *Chairman*, D. M. Buck, R. B. Dimmick, J. A. Aupperle, H. S. Marsh, Ernest Richardson, C. A. Blackburn, L. A. Adams

Research (Cast Iron)—R. R. Danielson, *Chairman*, W. C. Lindemann, H. R. Mills, M. E. Manson, E. P. Poste, B. B. Kahn

The various committees are now actively at work and there is every promise of the Enamel Division becoming increasingly important and valuable to those connected with the enameling industry.

A meeting of the Research (Cast Iron) Committee was held at Cleveland, Ohio, on May 11, with the entire membership of the Committee present. A comprehensive program of an investigation of cast iron for enameling purposes was drawn up at that time with particular reference to the blistering of enamels applied to cast iron. This investigation will be conducted in coöperation with the Enameled Metals Section of the Bureau of Standards, and it is hoped to interest actively all casting on enamelers of the Enamel Division in the work through a questionnaire to be sent out by the Secretary at an early date.

The Research (Sheet Iron and Steel) Committee has planned an investigation of the warpage and buckling of iron and steel sheets in the enameled process. It is planned to conduct the preliminary studies at the Bureau of Standards, this to be followed by coöperative work in several of the enameling plants engaged in the enameling of flat sheets.

The Committee on Data has planned the preparation of an index of the enamel papers which have appeared in the *Transactions* and *Journals* of the Society. The index will probably include other information pertinent to the Division.

The By-Laws of the Division have been revised to conform with revisions in the Constitution of the Society and copies have been sent to the members of the Division for vote.

The Division now has a membership of 21 Corporation, 39 Active and 150 Associate Members.

American Ceramic Society Summer Excursion Meeting

Rochester, Montreal, Ottawa, Kingston, Toronto, Hamilton, Niagara Falls, Buffalo

August 13–19 inclusive

Inspection of Feldspar Mill—Enamel Plant—Glass Plant—Wall and Floor Tile Plant—Brick Plant—Hollow Ware Plants—Electric Porcelain and Abrasive Plant—and the famous Canadian Feldspar Mines at Verona.

A delightful trip by water from Rochester, N. Y., to Montreal, Quebec. The famous Thousand Islands. DAYLIGHT TRIP from Thousand Islands to Montreal. A never to-be-forgotten trip filled with beauty and thrills. Running all the rapids. **The Galops and the Rapids duPlat** are the first and least exciting, though they are bounded by wooded curves that make this stretch of the river one of incomparable wonder.

Long Sault Rapids next: The greatest of all the St. Lawrence; nine miles of seething water between cool green masses of wooded islands.

Coteau Rapids: Tortuous, winding in and out among seven miles of islands.

Cedar Rapids: the most beautiful of all.

Split Rock Rapids: Difficult to navigate.

Cascade Rapids: White crested and foaming.

Lachine Rapids: The last of the rapids, narrow, twisting, irregular.

Sounds exciting and it is!

THE SCHEDULE OF ITINERARY

Sunday—August 13th: Lv. Rochester, Boat, 10:45 P. M.

Monday—August 14th: Ar. Montreal, 6:45 P. M.

Tuesday—August 15th: Montreal.

Wednesday—August 16th: Lv. Montreal, 8:30 A. M., Ar. Ottawa, 11:30 A. M.

Thursday—August 17th: Lv. Ottawa, 10:40 A. M.; Ar. Verona, 2:34 P. M.; Lv. Verona, 6:35 P. M.; Ar. Kingston, 7:35 P. M.; Lv. Kingston, 10:30 P. M.

Friday—August 18th: Ar. Toronto, 7:30 A. M.

Saturday—August 19th: Lv. Toronto, 9:15 A. M.; Ar. Hamilton, 10:15 A. M.; Lv. Hamilton, 2:30 P. M.; Ar. Niagara Falls, 4:15 P. M.

EXPENSE OF THE ENTIRE TRIP

	Fare	Lower	Upper	Seat	Total
Rochester to Montreal	$11.55	$2.50	.....	....	$14.05
Montreal to Ottawa to Verona to Kingston	7.80	.....	.....	1.30	9.10
Kingston to Toronto	6.10	2.75	.....	....	8.85
Toronto to Hamilton to Niagara Falls	2.90	.....	.....	1.20	4.10
					$36.10

Upper Berths 50c less than lower. Drawing Room four times the Lower Berth Rate. Daily additional expense $10.00 per day. Meals and Hotel per single person.

Estimated Maximum Total Expense $100.

IMPORTANT NOTICE

EXCURSION TO ENGLAND

Owing to industrial conditions here, as well as in England, the excursion to England has been postponed until the Summer of 1923.

COLLOQUIUM[1] ON FELDSPAR AND FELDSPAR DEPOSITS[2]

(This colloquium was led by Raymond B. Ladoo, mineral technologist of the U. S. Bureau of Mines. His preliminary report on this subject, as published in the *Bulletin*, issued by the Society February 20, was the basis of this colloquium.)

The outstanding features of the present feldspar industry as given by Mr. Ladoo are as follows:

(1) Many grinding companies do not own or control all or even a major part of their sources of crude material, but buy in job lots from many sources.

(2) There is a great need of more adequate engineering and chemical control over mines and mills.

(3) Out of date, inefficient methods and equipment for mining and grinding are in common use.

(4) Little or no coöperation exists between feldspar producers, but on the contrary many feldspar companies are exceedingly secretive. This tends toward (*a*) preservation of obsolete methods; (*b*) want of knowledge of the essential features of production, market requirements, and the relation between total milling and consuming capacities of the country; (*c*) inefficient and often mistaken trade practices; (*d*) unprofitable and even ruinous competition in dull periods.

(5) The small size of many feldspar deposits precludes maintenance of an efficient organization at each individual mine.

(6) Many of the best deposits of feldspar situated close to railroads are becoming depleted, which results in gradual lowering of grades, and increase in cost for better grades.

(7) There is a lack of exact knowledge of the ceramic properties and behavior of feldspar by some consumers, which results in (*a*) purchase of feldspar on the basis of price alone, thus encouraging low production costs at the expense of quality, and (*b*) inefficient and expensive crosshauling of both crude and ground feldspar.

(8) The grinding capacity of the country greatly exceeds the consuming capacity. There are more than 25 mills with a total capacity in excess of 300,000 tons per year, for a normal consumption of not more than 150,000 tons per year.

(9) There is a lack of uniform tests, specifications and standards of quality and fineness for different uses; and lack of standard definitions of grades.

Suggestions given by Mr. Ladoo to improve the situation are as follows:

(1) Gradual replacement of all of the present mills by a small number

[1] NOTE:—Article X (10) *Constitution of the American Ceramic Society.*

The Society is not, as a body, responsible for the statement of facts or opinions expressed by individuals in its publications.

[2] White Wares Division, Annual Convention, St. Louis, March 1, 1922.

of new grinding mills designed by competent engineers and equipped with the latest and most efficient machinery.

(2) Ownership or control of sufficient deposits of high-grade feldspar by the grinding companies to supply their entire requirements.

(3) Setting up of standard grades and specifications for feldspar for all uses.

(4) Instituting of centralized chemical and engineering control over all mining and milling operations, so that an absolute check on quality may be had at all times.

(5) Close coöperation among producers and between producers and consumers in order to promote greater knowledge and confidence and a more intelligent production and utilization of feldspar.

Discussion on Feldspar

MR. LADOO:—This report was made at the request of a group of potters who came to the Bureau of Mines and asked that a thorough investigation of the feldspar industry be made. I spent nearly a year collecting the information that went into the report, and before the report was issued, I submitted it to eight or ten different people representing different branches for criticism, and all of the criticism received was incorporated into this paper, so that this paper not only represents my opinion, but the opinion obtained from various sources.

MR. SLADEK:—Did Mr. Ladoo inquire into means for increasing purity of the ground feldspar?

MR. LADOO:—I have discussed that question in reference to iron. I do not know whether a process can be worked out to eliminate iron. It has *not* as yet been done. It is a subject which ought to be investigated further.

MR. A. A. KLEIN:—I see no reason why there should not be some method devised to do away with these iron particles.

MR. SPURRIER:—The question of separating iron from feldspar is not alone a question of separating iron by magnets. You may thus purify the feldspar as much as you can, getting all the iron out that is practical, and some will still be left. I have seen a magnetic separator used by potters with both good and poor results. There is one thing to be remembered, no matter how well you make the separation, nothing will ever give you absolutely iron-free materials when using the magnetic separator alone. You are almost certain to get free iron in your material simply from the mechanical handling. If your maintenance gang is working in proximity, it is not certain they will not let some iron drop into what you are handling. In any case a potter cannot be excused for not using some sort of separator. I think the best place for the magnetic separator is in the slip, but even

here I do not think you will ever get complete removal of the iron. To do it most effectively, your layout has got to be very big, and that involves a very big item of expense.

Mr. Ladoo:—I think an improvement could be made in some mills by putting in a magnetic separator between the coarse crusher and the fine grinder, to remove iron which comes from the crusher plates, and thus do away with some of the iron which is bound to get into the product from handling. I think that can be done very well in some cases at least. In some processes magnetic materials are removed by magnets. I have heard in the past year of two or three installations of a process that would remove a considerable amount of such materials, but I very much doubt if even that process can economically give a pure enough product.

Mr. Jos. P. Rodgers:—I have been in the business a number of years. About a year ago, a large manufacturer made a number of tests producing a sample that looked pretty good. I ordered a carload and ground one half of it through a Hardinge mill; the other half through an out-of-date apparatus, and then had the two products analyzed. In about fifty analyses during the past year this quarry has shown an iron content averaging .18%. In the tests that we made of the feldspar after grinding from two different forms of apparatus, there was not a difference of 0.01% between the two feldspars. We had three analyses made of the Hardinge mill grind, and three analyses made of the granite chaser grind.

I wish to read a discussion of Mr. Ladoo's report which I have written.

Mr. Ladoo has undoubtedly presented many points of merit, yet from my own viewpoint, I am unable to see that we have been given anything that will materially assist us to give the manufacturer of Ceramic products a better material at a better price. I am not in a position to speak for other millers, and can only judge from what we are doing and in the light of my own experience, which has extended over nearly 30 years. It seems to me that Mr. Ladoo has been unduly severe in his criticism of our end of the game.

The condition of the feldspar business in 1920 was a temporary one, due entirely to the fact that 90% of the business men of the country lost control of their labor, lost their heads and made a wild plunge for profits. The feldspar miller was not alone in this respect, but his capacity for doing damage was greater, and for that reason, he is better remembered.

So far as the ownership of mines is concerned, I was under the impression that most of the old line millers, either owned or controlled considerable deposits. I know there are a number of millers who do not control mines, but these people are doing business because of the philanthropy of the feldspar consumers and, having no responsibility, dump the onus of their errors on other millers who have sins enough of their own.

So far as engineering and chemical control is concerned, we are doing

what Mr. Ladoo says we ought to do, and then some. Our Company uses 150 gallons of kerosene each month to operate a testing furnace. We have a complete set of test screens and use them daily. We employ a reputable chemist to keep us posted on the composition of our crude materials, and the man in question had two years practical experience in work of our character before he began to do our analytical work. It is true, as Mr. Ladoo says, that we do not do this work at our mine. We do it in a chemical laboratory where naturally, one would expect it to be done.

As to the series of paragraphs on inefficiency at mine and mill, I think you will grant that what is efficient and what is not, is largely a matter of opinion, yet I cannot help but feel that Mr. Ladoo has picked out for his "horrible examples" one or two radical instances which could hardly be considered as typical of the industry. Surely the concern which required six handlings at its mill is not one of the country's large millers. At our principal deposit the feldspar is mined in an underground shaft, and when it is broken it is loaded into a skip or mine car, hauled out of the mine and dumped on to a grizzly where it is sorted either for a truck to the railroad or a cart to the refuse dump. When the car reaches the mill, the feldspar is forked into crude feldspar bins and from there it is wheeled either to a large crusher or to a chaser mill.

We are not dependent entirely upon what Mr. Ladoo terms an out-of-date style of mill, nor have we adopted, I am glad to say, all of the innovations shown on his flow sheets. In one department we have an old type chaser mill and a finish mill and in another we have the large and small crushers, the conical mill and finish mill. The last named operations are far more efficient than the chaser mill, but some of the largest users in the country will not buy feldspar that is handled through a rock crusher, and the conical mill cannot be adequately fed without one. As I have said, we have them both; you "pay your money and take your choice."

A few weeks ago a competitor asked my advice on the proposition of installing a rotary dryer such as Mr. Ladoo suggests. He had been quoted $2800 for the dryer, and the motor, shafting and cost of installation would add $700 more. I happened to know that he could cover the floors of his crude feldspar sheds with a steam pipe pan and install a boiler to produce his steam all for $900 and the cost of operating the outfit would be about the same as the operating cost of a rotary dryer, consequently, we could not see the advisability of that part of Mr. Ladoo's plan.

In another place the capacity of the Improved Feldspar mill is placed at 4 tons per hour. The most feldspar we are able to force into a 22-inch mill is 4500 pounds per hour.

The 30-inch mill has an advertised capacity of 10% greater than the 22-inch mill. I submit that it would be a difficult problem to take more out of the mill than you can put into it.

One of our competitors recently bought a much advertised air separator. It is said that he bound the selling company to secrecy before he placed his order, and that he has whispered to consumers the supposed fact that because of this separator, "all your feldspar troubles are ended now, henceforth and forever." Various forms of air separators have been sneaked into feldspar mills to my knowledge for the last twenty-five years in the hope that something practical might be developed. One of the principal impurities in feldspars is mica, a much lighter substance than feldspar, and the air separators gather up all the light weight mica with the finest grinding of feldspar, which we want for our highest grades, with the result that all the mica becomes segregated in the fine feldspar.

Another competitor, an older miller, probably knowing the futility of air separation, experimented recently with the screening process but the abrasiveness of feldspar caused his screens to wear out faster than he could put them into the machine. It is said that the experiment showed that the cost of this kind of treatment would add more than $1.00 per ton to the price of feldspar, and the miller would not be getting anything except the doubtful value of advertising a project that did not work out to practical advantage.

And now a word for the intermittent mill, the type for which it has been said "that fine grinding under these conditions is like trying to pulverize sea sand by striking the beach with a hammer." That is a very pretty simile. I regret that practical experience knocks it into a cocked hat.

The finest grinding of feldspar in this country today and for the past twenty years is required by the Orford Soap Co., makers of Bon Ami. Their specification demands a test by which 16 ounces of feldspar is stirred into a couple of gallons of water and then run over a 200 mesh brass lawn. In these 16 ounces there are 7000 grains. If the residue on the screen when dried weighs in excess of 5 grains (about $^1/_{12}$ of 1%) the material is not acceptable. I think you will admit that this is a severe test. Fineness of that kind cannot be obtained in a continuous mill. No form of air separation has yet been devised that will give it to you in quantity sufficient to make it commercially valuable. How then do we get it? Why, by "taking our hammer down to the sea shore" and grinding in an intermittent mill.

There is plenty of feldspar to be had from experienced millers, which in any kind of normal times will be carefully selected, up to the price you are willing to pay for it, and *down* to any price the miller has to take for it. Do not spend all your time reforming the miller. Take a little of the medicine yourselves, and remember that it may be well to limit your purchasing agent to feldspars that have borne the tests and the practical examination of ceramic engineers who know their business.

Mr. Ladoo:—Mr. J. P. Rodgers has prepared a serious indictment. I talked with Mr. Rodgers quite a while on the train, and I am convinced

that his idea of the feldspar industry and mine are not so far apart as his criticism seemed to imply. He spoke of the condition during the past few years. That is absolutely correct, and I realize that practically no effort to improve on the milling methods has been made. During the past few years, as a matter of fact, improvement has been at a standstill. That horrible example which he mentions, I believe I am right in saying, refers to one of the oldest and one of the largest feldspar grinding companies in the country. It is also true, as he says, that the grinding efficiency has been increased by drying. If the plant is run by steam, it might be much cheaper to use your waste steam to run your drier instead of the method suggested by Mr. Rogers, but if your mill is electrically driven it might be cheaper to put in some form of a rotary drier. The statement of capacity of the mill is actual and not estimated. Mr. Rodgers stated he gets 4500 pounds; that is two and one-fourth tons—is that with a drier or without?

Mr. Rodgers:—That is working on the dry material, but not material that has been dried artificially.

Mr. Ladoo:—I believe the grinding capacity when grinding some materials can be increased by drying and the capacity of the so-called ideal material can be enhanced by use of the air separator which takes out the fine material. This would increase the capacity of the mill making it possible to get four tons through the largest type of Hardinge mill. With reference to mica, that is a proposition that must be worked out a little further before determining whether or not air separators can be used on all types of feldspar. But I cannot see how the question of mica is involved in the use of air separation, because there appears today to be but two means of getting out mica. First, the mine run may be selected to exclude all the mica the feldspar contains. The only alternative seems to be by screening. Screening, I will have to admit, has not been very successful. In fact, screens have been thrown out of feldspar mills as being unsatisfactory for the reason that the screen wears rapidly, mica gets into the openings, and the screens blind. If the mica cannot be removed by hand sorting or screening, it must stay in. If the mica stays in, I do not see that an air separator can either improve or injure the product. I do not believe that any manufacturer of air separating equipment would claim he could get out the mica. I have never seen one that could. Air separation, as used today, is a sizing, not a purifying, process. I do not think the questions of mica and air are at all connected.

Mr. Smith:—We have two mills. In one of them we use a large crusher. It is an 8 x 10 crusher. So far as our practical experience has been, I think there is almost no difference in analysis between the product of one mill and that of the other with the manganese steel jaws.

Mr. Ladoo:—That to me would seem absolutely correct. I cannot see how the crusher with the manganese steel jaws can add any more iron

than would be added by sledging and the various methods of handling. You would probably add just as much iron or more iron by sledging than by using the crusher. I think some standard should be obtained on that point.

There is one point which I would like to emphasize in the defense of the feldspar millers, and that is the question of price. The price of ground feldspar has not gotten back to pre-war prices and it never should unless conditions change radically. I hope it will not under present conditions because it would mean bankruptcy for many feldspar companies.

I think the parties that should be most interested in obtaining adequate supplies of uniform crude material should certainly be willing to pay a price which will give the feldspar millers a seasonable profit. The history of feldspar mining in this country and Canada shows that the industry in the early days was very crude. They took the finest feldspar closest to the railroad, discarded all the rest, threw it away on dumps, and moved on. Now they must either use the lower grade of materials near the railroads or haul the material which is located further away from the railroads. The costs must be higher if feldspar must be hauled long distances. I can see no return to the low prices prevailing before the war.

Referring back to the question of iron in the feldspar, what percentage of iron aside from specks of metallic iron should be allowed in feldspar? What amount could be tolerated in high-grade feldspar?

Mr. Spurrier:—I am afraid that is a proposition that cannot be answered. It would be out of the question to estimate that. I would not want to say how much; we should have a standard.

Mr. Ladoo:—I think it is very important for the purchaser and consumer; (they go hand in hand) that some form of standard should be settled upon. If the potters try to set up absolute standards, the feldspar millers might find them impossible to meet. If the millers attempt to set up standards, the potters might take issue. I think they both should get together and work out standards mutually acceptable.

Discussions Received since St. Louis Meeting

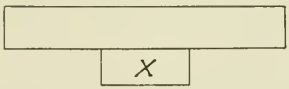
By R. H. Wainford:—As our company is one of the oldest and largest feldspar concerns (capacity 1600 tons a month) it will not, we hope, be out of place if we take up the cudgels in defense of ourselves, and also of our mining and grinding friends, as we feel that the statements made by Mr. Ladoo are very sweeping and while there may be instances that give color to all of his assertions, we hope and feel that they do not apply to our industry as a whole.

This paper will, no doubt, be read by the pottery manufacturers, who urged the investigation, with as much interest as the feldspar producers

themselves, the investigated parties, as consideration of this subject has been extended away beyond our fields of endeavor and right into the very core of the ceramic industry itself of which the feldspar producers are only a minor incident.

It seems to me that the mining experts of the Bureau of Mines in this investigation have neglected the vital parts of the feldspar industry, *viz.*, the prospecting and getting of feldspar. Prospecting for and quarrying of feldspar is many times more vital to us than the grinding which is a mechanical process.

The paper refers to other industries that have gained by the adoption of scientific and automatic processes, while the ceramic industry has contented itself with old fashioned ways; engineers unacquainted with pottery plants very often make this analogy, the pottery industry, however, is totally unrelated to any others. Again let me say, I am entirely out of agreement with Mr. Ladoo on this question of out of dateness compared with the steel trades or any other and the pottery trades. There has been just as great advances in every sense that need to be applied in the industry now under the magnifier. Mr. Ladoo has shown two flow plans; the first being a grossly exaggerated case and the other ideal. They remind me of a black board sketch made at the Philadelphia meeting of this Society. The sketch looked like the one given here:



The little chap on the side was explained to be the combustion chamber, that when properly designed would end, for all time, kiln-firing troubles that have been troubling the potters for the past hundreds of years, and give money in the pocket besides. I have marked this wonderworker with the letter (x) as this is the algebraic sign many of the members have been looking for since that time.

I will now endeavour to reply to Mr. Ladoo's "outstanding features" numbered 1 to 9 on the first page of his paper. These might have been styled "charges."

(1) In regard to the statement that many grinding companies do not own or control their supply, I would say that for our Cathance, Me., mill, we have obtained feldspar from our own quarry for over 50 years. For our Trenton Mill, we obtain feldspar from a New England State, and before obtaining this quarry we investigated a score of deposits in this country and Canada, making a large number of analyses and physical tests of samples from prospectors whose deposits were for sale. So we do not buy in job lots.

(2) The engineering control of our business is unfortunately in the

inadequate hands of myself, a mechanical engineer, so titled by the British Institution of Mechanical Engineers. The quality of product control has been in efficient and trained hands. One of our mills and the deposits attached to it were superintended for about forty years by a gentleman whose name was known to all the whiteware manufacturers of the old school in this country. Unfortunately he has now passed away. He was always inquired of, with not only esteem but affection, and our product was as much known by his name as ours. Our present manager and superintendent, trained at Harvard and Massachusetts Inst. of Tech., is this gentleman's son, and was his assistant for 16 years before taking over the official duties. Our mill at Trenton and its deposits of feldspar are in the main looked after by one of the products of Prof. Brown of Rutgers. The treasurer of our company who has been connected with the manufacture of whiteware pottery all his life also interests himself in both plants. He professes to be a "practical potter" and only hopes that he gets somewhere on the outskirts of this designation; if he reaches that, he wishes me to state that he desires no better compliment.

(3) Regarding the out-of-date and obsolete inefficient methods of grinding; our mill in Maine was first operated by water and so was placed where there was a head of water. It was fortunately also at the head of tide water, where, before railroads were operated, the ground product was bagged and sent down the river in boats to its destination. Years passed along, the railroad came within a quarter of a mile of the mill and the product was then loaded on the railroad. As years passed, the forests were cut and water became more and more intermittent; then we put in a steam plant and at a later period an electric plant to keep in touch with modern witchcraftry. We, however, still run this mill by water power, when the head of water is available, which it is for about three months in the year.

Our mill at Trenton, was erected last year. We concluded after a great deal of thought to continue to use periodic cylinders and chaser mills. There may be other methods which many would think are more efficient and produce a better product, but we have produced a definite product for many years, hence our choice of machinery is not without experience or knowledge of what is the best. This plant is electrically equipped and provided with suitable apparatus to protect the health of our employees and has such devices for the manipulation of the products that seemed desirable, always bearing in mind as we had to do, that what our customers want is not how automatically we can run our mill, but the proper kind of feldspar which they use as only one of the ingredients in the manufacture of their products.

(4) We do not know what is meant by lack of coöperation among feldspar producers. They are not secretive. When Mr. Ladoo visited us

at Trenton, he was shown around our plant, which was then almost completed for working and was given a letter of introduction to our manager in Maine asking that he be shown every civility and given such information as would be useful for his report. He was invited back to Trenton to see the mill in operation which he promised to do, but did not return. Our fellow feldspar producers have been invited and some have visited our mill; a number of our customers have also done the same. From this it will be seen that we are not secretive in our methods; at the same time, we hardly see why a manufacturer must be taunted if he refuses to throw his plant open for public inspection.

(5) This is probably so.

(6) We presume that deposits of feldspar near a railroad that are continuously worked will get depleted, for what is taken out can never be replaced. If any one knows of a good deposit of feldspar near a railroad, we hope that he will not be secretive, but show a broad spirit and put us in touch with this desirable spot.

(7) We are going to leave it to our manufacturing friends to either defend themselves or excuse their shortcomings as pointed out in this paragraph.

(8) We think that more than half the capacity of grinding mills is taken up in grinding flint, cornwall stone, french flints, etc. We may be charged with wasteful over-production in building our new mill at Trenton, but in partial explanation of this we desire to state that twice our mill at Cathance, Me., burned down, and we were put out of business for long periods. We built this mill to protect ourselves against a recurrence of this fate. We can now carry greater stocks of finished material and fill orders in rush times.

(9) We regret that Mr. Ladoo has made this statement without being more explicit. Of course we do not intrude in the manufacturing operations of our friends and can only answer for ourselves, though we see no reason why they should not have some glimmering of intelligence in the preparation of their materials.

We have always had tests made for uniformity of our products and a standard of grinding. This is looked upon as being one of the fundamentals that are essential to a product like ours and which the potters who buy from us naturally expect to get.

By Harlowe Hardinge:—Mr. R. H. Wainford has made a very comprehensive discussion of Mr. Ladoo's article on the grinding of feldspar and there is no denying that many of his points are well taken, although I do believe that he has misunderstood the intent of some of Mr. Ladoo's recommendations.

Mr. Ladoo's reference to the adaptation of a process employed by one industry to another, in my opinion had reference to methods of grinding in the mining practice as compared with the ceramic industry, for in the treatment of ores, fine grinding plays a very important part in the whole process, and as a result, as much energy is exerted in solving this problem as in all the rest of the processes put together. It is here where the costs are usually the highest.

The mining industry has reached a stage where the saving of a few cents per ton of ore ground means a great deal, and in some cases spells the success or failure of the entire project. Literally, hundreds of methods of grinding have been tried out in this industry and only four or five systems have survived, all of which are continuous in operation. These systems involve wet grinding but the same condition holds true for fine dry grinding as has been demonstrated in many cases on record.

The present method of grinding feldspar by the intermittent process, usually with chaser mills or batch tube mills, is still profitable. No one can deny this point when we consider that in grinding in this manner the established producers are making money, for so long as this method is generally employed in the ceramic industry, those producers will continue to profit.

What Mr. Ladoo brings out is that the better known producers may be superseded by new companies who "take a chance" on installing a continuous system and are able to produce just as satisfactory a product for about half the cost. The well-established companies will not feel this competition until there are enough installations of the new system which are able to secure a satisfactory grade of feldspar and sell their product considerably below that which the older companies could afford, or unless these older companies fall in line and cut their production costs to meet the "young competitor."

There are many "ifs" to this argument, it is true, but there are enough facts which have shown a disinterested investigator like Mr. Ladoo what will come to pass.

Mr. Ladoo certainly laid himself open to attack when he recommended changing the milling system to such a radical degree, but it stands to reason that unless he had had ample proof that such changes had effected the economies claimed, he would never have dared present such radical recommendations.

It was intimated that Mr. Ladoo showed partiality to a particular system and advocated certain types of apparatus. Why shouldn't he if by so doing a benefit to the producer would result? The benefit derived by the manufacturers of the machinery involved in this plan is negligible compared with that accruing to the producer through years of operation.

By R. F. Segsworth:—Mr. Ladoo's paper on conditions in the feldspar industry impressed me both by the soundness of the theories set out and by the fact that the findings given as to conditions in the industry correspond closely with the results of our own prior investigations. Mr. Wainford's reply thereto has left the above impression unaltered.

We leave to Mr. Ladoo the replying to the criticism of the general scope of his inquiry, the form of his report, the question of whether or not his suggestions have been only destructive and not constructive, and the possibility of submitting further evidence in support of his assertions. Suffice it to say in passing that the improvements suggested do not appear to be in use by all companies, and that thirty-five or more years' experience is no answer to Mr. Ladoo's criticisms.

The discussion naturally falls under two heads: (A) Mills and consumers. (B) Mines and producers.

(A) With the first of these, we, in Canada, are but little concerned, owing to the almost entire absence of any grinding mills. At present there is in operation only one small mill. In view of the immense quantities and high grade of feldspar still to be mined in Ontario, the question of establishing mills in Ontario should be of interest to American grinders and consumers. The following figures show the production of crude feldspar in Canada, and in reading these it should be remembered that the Richardson mine at Verona, Ont., one of the largest producers of high grade feldspar on the American continent, has been shut down for the past four years, but is being re-opened within the next three months.

Feldspar Sold (Tons)

1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
17724	13733	15935	18060	15455	19488	19462	18782	15955	32000

Up to the present, Canada has exported practically all its crude feldspar to the United States and imported from them nearly all its annual consumption of ground feldspar. At least 95% of the production of Canadian feldspar has come from the County of Frontenac in Ontario and the County of Ottawa in Quebec, and 90% of the total Canadian production has come from the Verona district in the County of Frontenac, near Kingston, Ontario. Recently deposits in the Buckingham district in the County of Labelle, Quebec have been opened which indicate the presence of a considerable quantity of feldspar of good quality. In 1900 the Verona district produced 4000 tons; in 1920 it produced 32000 tons. With improved transportation facilities, and the consequent reopening of the largest quarry in the district, the next year should see this production practically doubled—a field well worthy of the consideration of the American grinders and consumers.

(B) Mines and Producers. The conclusion to which Mr. Ladoo comes

in this connection is that the great need of the industry at present is a continuous production of high grade feldspar of a uniform quality. To this, Mr. Wainford's only answer is a challenge: "If any gentleman knows of a good deposit of feldspar near a railroad, we hope he will not be secretive, but show a broad spirit and put us in touch with this desirable spot." This challenge we accept.

(1) Quantity. We have referred already to the quantity of feldspar available in the Verona district. Perhaps it should be added that competent engineers have estimated that the Richardson quarry contains at least 300,000 tons of high grade feldspar; the same authorities believe that much greater tonnage is possible but this tonnage they consider certain. Anticipating the improvements now being made in transportation facilities, some 4000 tons of feldspar of a uniform grade are now ready for shipment.

(2) Transportation. There are a number of properties in this district only a few of which have been operated. None of them have been on a railroad and this has held back greatly their development, as the bush road has been possible only during a few months of the year. However, this drawback is now being completely removed as a means of transportation will be completed as soon as the frost is out of the ground, whereby shipments can be made at all seasons of the year. With the completion this spring of these works, it is expected that all quarries in the district will be operating at full capacity.

(3) Quality. The analysis given in the Bulletins on Feldspar and records at Washington, London, Ottawa and Toronto earmark the feldspars in the Verona district, Ontario, as being of high grade and in spite of the disadvantage of lack of transportation facilities they have always been able to get and keep a fair share of the high grade demand in the United States.

Bulletin No. 420 by Edson S. Bastin, issued by the United States Geological Survey is the most authoritative and comprehensive treatise on the feldspar situation in the United States. Under Grade and Prices, page 21, Bastin says: "Most dealers recognize three grades of commercial feldspar: No. 1, No. 2 (sometimes called Standard), and No. 3. No. 1 is carefully selected, free from iron bearing minerals, largely free from muscovite and contains little or no quartz, usually less than 5%. Analysis 6 of the table on page 9 shows the character of material of this grade. On the same page Bastin gives a list of prices for crude and ground feldspar—crude Canadian feldspar is quoted at $0.50 a ton higher and the ground Canadian feldspar at $1.00 per ton higher than any other grade. In all publications on feldspar the Canadian feldspars are given as examples of typical high grade, hard, potash feldspars.

By H. Spurrier:—In considering the question of feldspar it is obvious that the rock should be suitably free from objectionable minerals such as excess silica, mica, garnet, etc. This being the case, the question resolves itself into what happens to the feldspar during (1) grinding and milling; (2) transportation; (3) its sojourn in the potter's bins; (4) its being made into slip.

During all these experiences the feldspar is exposed to liability of contamination with free metallic iron or iron oxide. Contamination with free metallic iron or iron oxide is far more objectionable than an equal amount of iron existing in a more complex state of combination.

The following data relative to the amount of free and combined iron in potter's materials may be of interest.

The total iron content of a well-known ground feldspar showed on analyses, made ten months apart, 0.53% and 0.50% calculated as Fe_2O_3 and nine months later 0.45% Fe_2O_3.

The same feldspar showed on a careful magnetic separation 0.0016% metallic iron. A widely used domestic kaolin showed on two analyses made eleven months apart 0.80% and 0.68% of iron oxide. A careful magnet separation showed metallic iron 0.0004%.

Two samples of the finest white Canadian orthoclase feldspar showed 0.26 and 0.18% Fe_2O_3. These specimens were of extraordinary clearness, a fine hand specimen of two inches thickness being distinctly translucent. In preparing these samples for analysis they did not come in contact with iron at any time.

The following survey of the metallic iron content of raw materials, and dust made for dust-press practice from these materials may be of interest.

Feldspar taken from bin gave metallic iron 0.0016%. Flint taken from bin gave metallic iron not weighable. Standard mix made in porcelain mill and not coming in contact with any iron—0.00036%. Commercial slip coming from blunger before reaching electro-magnets—0.00129%. Dust from dust house—0.00193%.

An examination of dust collected in the immediate neighborhood of a crusher used in preparing dust showed an iron content of 0.011%. The iron content in this dust was not of the minutely fine character formerly noted, but appeared to suggest hack saw dust.

While the above facts may not be entirely pertinent to a discussion on feldspar, they are nevertheless, not entirely irrelevant, and would seem to indicate that potters need to "clean house."

As far as my own experience goes it seems that the crux of the situation lies in the selection of the proper grade of feldspar before crushing and grinding, as there seems little to fear from grinding and milling as practiced by reputable millers. Surely potters have no complaint to make of a feldspar that shows 0.0016% of metallic iron and this iron of a great degree of fineness.

By N. B. Davis:—Perhaps Mr. Ladoo has been carried beyond practical bounds in his endeavor to describe the conditions in the U. S. Feldspar Industry, but he has, nevertheless, succeeded in stirring up considerable interest that should eventually mark a period of advance.

During the past two years 3 or 4 new plants for grinding feldspar have been built in the United States using continuous and intermittent types of grinding equipment. There are two different systems of continuous mills—one using screen separation, and the other air separation, in sizing the final product.

It would be of considerable benefit to the industry as a whole if a study of results obtained could be undertaken and the data presented to the Society.

It is difficult to understand why advances should not be made in the milling of feldspar when all other industries turning out fine products have recorded improvements.

It is true that in general the milling costs of feldspar are too high, mainly because of the limited grinding capacity of the individual mills.

The problem of grading feldspar appears to have received the least attention in the original paper or in the subsequent discussions. From the standpoint of straight feldspar there are no commercially pure potash or soda silicates, but there are innumerable mixtures of the two, due to natural intergrowths and the material on the market shows this considerable variation. Products that are not feldspars but mixtures of quartz and feldspar with the latter predominating, are referred to by some producers as No. 1, while other producers rightly term feldspars without impurities, No. 1.

Would it not be better to have standards arranged for various products, and in this way aid the potter in looking for his sources of supply?

I am sure the Canadian producers are not at all secretive, and are only too glad to have visitors call on them. Speaking for our own interests, I might say that we would be very glad to have anyone interested spend a day with us at our quarries.

Prior to 1921 a number of grinders operating their own quarries shipped material that they would not accept from outside producers, and as a consequence, when the call came for a greater production, particularly during 1920, the whole grade of the output was lowered. Then came the complaints of the potters.

Mr. Ladoo was quite right in saying that eventually the quality of the material supplied would depend on the price allowed by the potters, so that in reality the ultimate consumer controls the quality.

By Edward Schramm:—Mr. Ladoo's very interesting paper deals primarily with feldspar milling problems. It may not be out of place to

present a few observations on feldspar from the point of view of the manufacturer of vitreous ware who is interested chiefly in quality.

The chemical requirements are high potash, low lime, low iron, and constancy of composition. A product high in free silica produced by the grinding of pegmatites or "graphic granite" like the Maine product is satisfactory, provided iron bearing impurities are low. However, the percentage of free silica in a feldspar of this type is likely to vary from time to time. Ordinarily these variations are not serious in a body composition, but for use in the glaze it has been found desirable to make a careful analysis and to adjust the feldspar contents so as to hold the SiO_2 proportion constant. Analyses are not required frequently if a carload shipment is set aside for use in the glaze only.

The determination of alkalis is frequently regarded as a stumbling block in the analysis of feldspar. However, with a little practice this determination can be made with great accuracy. Two critical points are the fusion and the separation of potash and soda. In the former, as shown by Hillebrand, the crucible should be heated to a high temperature after the initial slow heating to insure complete decomposition. The separation of potash and soda as perchlorates is very accurate if we use 97–98% alcohol which can be prepared by distillation of the 95% product over lime.

The production of a high grade feldspar depends on the success of the prospector in locating workable deposits with a high percentage of practically pure rock. We know of no commercially satisfactory method of eliminating such impurities as biotite, tourmaline, garnet, pyrite, hornblende, and surface iron, which introduce dark specks and impair the color of the fused feldspar. With regard to iron introduced in milling, we confess to being among those with a prejudice against jaw crushers because of the rubbing tendency in these machines. Chemical analysis of the product is not a sufficiently sensitive means of detecting this contamination. A few specks of iron sufficient to ruin the appearance of a fine china body, would hardly be found by the analyst. The only valid test is the comparative appearance of the buttons fired under identical conditions.

The fire test is conveniently made by placing a 50-gram sample in a heavy biscuit egg cup covered by a small butter plate and firing in the biscuit kiln. The purpose of this test is to judge cleanness and color. The degree of fusion of the button is not to be relied upon as an indication of fluxing power of the feldspar owing to the action of quartz in lowering the fusion point and to the increase in fusion point with increasing proportion of potash.

The fineness of grinding is a matter of great importance. The common use of metal testing screens of from 150 to 200 mesh gives little information to the consumer since such screens are not of the right order of fineness. The ideal test would be by elutriation or an analogous method, but this

scarcely appears feasible for routine work. The use of finer sieves gives a fair measure of the degree of coarseness. We use for the purpose either a XX16 silk lawn or a 250 mesh metal screen. The rejection on the 250 mesh metal multiplied by 1.4 will come very near the rejection on the XX16 silk. The particular standard rejection demanded will, of course, vary greatly with differences in manufacturing conditions. Silk lawns show considerable variations and the use of the metal screen is, therefore, preferable, even though the metal screens finer than 200 mesh are not guaranteed by the manufacturers as to uniformity of opening. In any case the material should be washed through the screen in slip form. The dry test is apt to mislead especially if the material is in a damp condition. This is particularly true of feldspar which has a greater tendency to matt than other materials.

By R. C. Purdy:—Mr. Ladoo described tests which millers of feldspar and the users of feldspar should make to obtain information regarding quality variation in constitution and accidental impurities. These have been touched upon by others in the discussions. I will here discuss only the chemical test.

A feldspar deposit that is worth working for A–1 feldspar can be quarried with a profitable output of clean mixture of feldspar and quartz, the feldspar portion of which will run constant in composition over quite a large portion of the quarry and a considerable period of time of milling. Records of shipments for month after month from three different quarries have shown that the composition of the feldspar portion of the material remained constant. The only variation was in the proportion of feldspar to quartz.

This having proven to be the case it was plain that it was not necessary to analyze the shipments for any thing other than SiO_2. Having determined by the hydrofluoric-sulphuric acid treatment the total SiO_2 in the sample, it is clear that the remainder consisted of the RO and Al_2O_3 of the feldspar. The SiO_2 belonging to this amount of RO and Al_2O_3 being known, it is readily figured, and this subtracted from the total SiO_2 gives the amount of quartz in the sample.

It is advisable for both the miller and the user to make complete analysis of the feldspar at stated intervals or whenever there is suspicion that the character of the feldspar mineral in the sample has changed. In my experience such a complete analysis was not necessary more than once in six months at the most and generally not more often than once in a year.

There is little to be learned from the difficult determination of the alkalis and alumina which is not disclosed by the easily accomplished and sufficiently accurate hydrofluoric determination of the total silica. For a routine test this determination is recommended because of its speed

and its closer approximation to accuracy than the determination of the alkalis or alumina by most of the routine chemists.

This simple test in connection with a petrographic determination will give more real information than will a total ultimate analysis, and the conclusions will be based on actual observations, there being no need for assumptions such as must be made when the mineral constitution of the sample is figured from the ultimate analysis.

By H. Spurrier:—Recently Mr. Schramm of the Onondaga Pottery asked me how I determined very small quantities of metallic iron in clays, feldspar, etc. After reading the method used he suggested that I forward it as a contribution to the discussion on feldspar.

Two and a half kilos of the material (feldspar, clay or flint), are well stirred up with water in a large tin lined or white enameled pan having wide flaring sides, as much like a miner's pan as possible.

Any lumps should be broken up and thorough admixture ensured, allowed to settle a few moments, and then any supernatant liquid together with a little of the solid material is poured off. This is repeated till the bulk of the solids has been reduced to about five hundred grams.

The procedure from now on is precisely that of the miner in "panning" gold. The contents of the pan are diluted with water, the pan being held at such an inclination over a sink that the water just comes to the edge. By an elliptical and gyratory motion the contents of the pan may be kept in agitation allowing heavy materials to find the lower levels, thus making it easy to allow only the lighter portions to be poured portionwise over the edge without any danger of losing heavy material. When a little dexterity has been acquired in doing this, it can be done very rapidly and with great precision. During the last part of this separation it is well to use distilled water.

The final bulk of the solids and water may be reduced to about 100 cc., which are washed into an evaporating dish, allowed to settle thoroughly, the settling taking place quite rapidly. All the supernatent liquid that can be safely poured off with the aid of a glass rod held at the lip of the vessel should be removed, using considerable care.

The residue should now be thoroughly dried and the dried mass carefully powdered. One pole of a powerful magnet, is now provided with a sheath of thin paper, which being thus protected is used to pick up the magnetic particles. On slipping the magnet out of the sheath held over a sheet of glazed paper the attached material, of course, falls off. This procedure should be repeated till examination with a good lens shows nothing but iron and the usually attendant particles of magnetic oxide.

The material may now be weighed on a chemical balance to the nearest

milligram, each milligram representing 0.00004%. It is as well at first to make a trial by adding a known quantity of fine iron filings to a definite quantity of clay and panning it. This will take care of the personal equation, which however will change as skill is acquired, and establish confidence in the result.

By C. C. Treischel:—Mr. Ladoo has provoked a discussion that can not help but benefit both producers and consumers if each will accept their share in the responsibility for the deplorable condition of our feldspar industry for the past few years. The producers' part has been pointed out. The consumers' share is their neglect in providing the producers and themselves with standard tests and specifications covering the different grades of feldspar used in the several branches of the White Wares industry.

The need of such specifications can not be denied. If prepared, they would assist greatly in the reorganization of the producing end of the industry. They would indicate to the producers just what was demanded by the White Wares manufacturers as to quality and uniformity. Standard tests would form a satisfactory law covering controversies over quality, etc. The matter of purchase of feldspar would then be on a sound basis and both buyer and seller would know where they stood.

I suggest that the Committee on Standards prepare suitable physical and chemical tests for feldspar. Further, I suggest that the Research Committee of the White Wares Division prepare purchasing specifications covering the various grades of feldspar used in our industries.

By Charles M. Franzheim:—This is unquestionably one of the best papers I have ever read pertaining to this industry. It is very comprehensive, complete and true to conditions, and I have read it with a great deal of interest and care from a critical standpoint.

How Mr. Ladoo hit the nail so squarely on the head, not being actually in the industry, is a revelation as so very few people in the industry, that is the old people, really get the right angle on the situation and he certainly has done so and is to be commended.

Hardinge mills, to our knowledge, have proven fine where only 100 mesh or less is required, but they have not proven a success, to us at least, where grinding feldspar 130 mesh or finer is required.

Our engineers in Maine, as well as ourselves, have visited all of the high class engineers in the country, sought all kinds of expert engineer's advice for better grinding methods, but so far we have not succeeded in changing our plan, without materially increasing cost. The principal reason for all this is because of the peculiarity of the feldspar rock itself.

However, we wish to congratulate Mr. Ladoo on this feldspar masterpiece. It is the best thing we have read, and hope it will be brought forcefully before the Society.

General Replies

By R. B. Ladoo:—Several discussions of my report on feldspar have indicated that the purpose of the report was not fully understood. When the Bureau of Mines was requested late in 1920, to investigate the feldspar industry the problem presented was: "What are the reasons for the continued shipment of poor and un-uniform grades of feldspar during the past few years and what assurance have the ceramic industries that grades in the future may be improved?" The situation seemed so serious that the Bureau felt that the investigation was justified, realizing, however, that the purpose and results of the work might be misinterpreted by a few people. The purpose of the inquiry, therefore, was to find and list the troubles of the feldspar industry which were directly or indirectly responsible for the shipment of poor feldspar. The point was not to report on all phases of the industry but merely upon the unfavorable aspects. During the course of the investigation much additional material was gathered which will be used in a later report on all phases of the feldspar industry but such additional information was not included in the report under discussion as it was not considered pertinent.

The investigation progressed during the whole of the year 1921. Visits were made to mines and mills and to undeveloped deposits, conferences were held with producers, consumers, consulting engineers and chemists both in this country and in Canada. All collateral information was obtained so as to enable the preparation of an unbiased report representing all phases and interests in the industry. After the report was prepared in a preliminary way copies were submitted to engineers, chemists, ceramists, producers and consumers for criticism, correction and amendment, and the criticisms so received were incorporated in the final report. Therefore, the report as issued represented not the author's hasty judgment but the well-considered opinions and experience of a large number of people representing all phases of the industry.

It was inevitable that the report should be misunderstood by a few people and that they should look upon it as a hasty and unwarranted attack upon the whole feldspar industry in general and upon their own operations in particular. This was anticipated but it was believed unavoidable. The Bureau believed that most producers and consumers would find in the report an impartial and disinterested exposition of the unfavorable conditions as found and that the criticisms would not be accepted where they did not apply. The only alternative to the issuing of the report as it stood

was to write a report which presented the good points and glossed over the weak points. Such a report might have been found more acceptable to a few but it would have been of no value technically and the work would have been wasted.

All of the conditions enumerated in the report were actually found in practice although of course they were not all found in any one plant and some applied to but a few plants.

Some objection has been found to the use of the names of specific machines in the flow sheets presented. It should be understood that the "suggested flow sheet of improved mill" is a composite flow sheet containing methods and machines found by experience to be the most efficient in actual feldspar grinding practice. Thus it is not a theoretical flow sheet but a composite flow sheet of methods and equipment from actual mills. Furthermore, it is not suggested that this flow sheet may be taken as an ideal flow sheet for the grinding of any particular type of feldspar. It is merely offered as a suggestion or as a basis for experiment toward the improvement of present methods. It is fully realized that some of the machines suggested can not be used successfully in the grinding of certain feldspars, but it is true that these machines have been successful in actual use in the actual grinding of other types of feldspars. Furthermore, it should be remembered that improvements in grinding and separating machinery are constantly being made and the fact that a machine was tried out some years ago and found unsuitable is not sufficient proof that the most modern type of this machine would not be successful.

It is true that the unsatisfactory conditions which prevailed in 1919 and 1920 were in part due to labor conditions and to unusually large demand. However, the dissatisfaction with some of the types of feldspar shipped began prior to 1919, and the causes of such unsatisfactory material were accentuated by the unusual conditions. Since the beginning of the industrial depression, late in 1920, feldspar producers have had an opportunity to select their feldspar more carefully, to weed out inefficient labor and to make repairs and improvements in their mills. Thus the feldspar shipped so far during 1922 has been of a better grade and it seems probable that many changes and improvements will continue to be made in the methods of mining and milling.

Engineering and chemical control, to a certain extent, is now being practiced by some of the feldspar producers. This control is more easily effected when the feldspar grinder mills only feldspar from deposits which he owns and operates himself and where such deposits are large and fairly uniform. The greatest difficulties arise when feldspar is purchased in small quantities from a great many different deposits not owned by the feldspar millers and assembled at one mill. At such mills blends must be made and it is very difficult to control the composition of the blend by present methods.

There seems to be some difference of opinion as to the most efficient method of fine grinding. In many of the non-metallic mineral industries, in which fine grinding is necessary, grinding was formerly done in pebble mills of the intermittent type but they have been largely superseded, except for batch grinding, by continuous processes. Thus in the grinding of barite, talc, whiting, etc., very fine grinding is now being done successfully in continuous mills either dry, using an air separator, or wet, using some form of classifier. The specifications for some of these products are very exacting and require material that will pass a 300 mesh screen. Since feldspar need be ground only to pass 140 mesh screen, or at the finest a 200 mesh screen, the possible increase in efficiency by the use of continuous grinding methods should at least not be overlooked.

By R. B. Ladoo (to R. H. Wainford):—It is with some hesitation that I attempt to reply to the discussion by Mr. Wainford for I believe that Mr. Wainford has not fully understood the purpose of the investigation and the meaning of the report. Furthermore some of this discussion is of such a nature as not to need reply. However, I will reply to a few of the technical points made in his discussion.

The nature of the investigation and the type of report desired precluded the possibility of going into details as to possible improvements in methods of mining and milling. The object of the report was to give as concisely as possible the reasons for the production of poor feldspar and a summary of some of the possible remedies. A detailed discussion of all phases of the industry was purposely left to another and more lengthy report which will be issued by the Bureau at some time in the future.

My references to improved methods in other industries were not based upon the iron and steel industries but upon other nonmetallic mineral industries which have passed through the same stage through which the feldspar industry is passing, for instance the cement industry and the lime industry.

The use of flow sheets in describing milling operations is so well established and is so well known that the use in my report seems to require no defense. As for the methods suggested, a careful reading of the report would reveal the fact that the suggested flow sheet was a combination of machines most successfully used in various plants visited. In other words it is a composite flow sheet of the best features of a number of plants. The use of these machines is not advocated for any plants but it was thought that this composite mill might offer suggestions for experimentation in the improvement of present practice.

The points covered in Mr. Wainford's numbered paragraphs one to nine are replied to in part in my general discussion. It is unfortunate that

Mr. Wainford considered my remarks only in their application to his own operations. It has been repeatedly pointed out that the faults enumerated in my report were but an enumeration of all of the faults found in all of the plants and that they do not all apply to any one plant, but, on the contrary, there are some plants to which but one or two of the faults would be ascribed. However, there is definite and ample proof that all of the faults enumerated may be actually found distributed over the whole industry.

In regard to secrecy of operations it is true that Mr. Wainford extended every courtesy to me while at his plants and I greatly appreciated the coöperation shown. It is also well known, probably to Mr. Wainford as well as other feldspar producers and consumers, that there are companies which are very secretive and which do not allow examinations of their plants and which will divulge no information either to competitors or disinterested parties. Fortunately this applies to but a very few companies.

The feldspar producing capacity of the country was very carefully computed not only from records of actual production but from statements by producers checked by a calculation of actual mill capacities. These estimates do not include flint milling capacity. This estimate clearly showed that there is an excess feldspar milling capacity in the country, a greater excess in fact than some feldspar millers realize or will admit.

By. R. B. Ladoo (reply to Mr. Purdy):—Mr. Purdy's suggested short method of analysis for feldspar can only be applied when the type of feldspar being ground does not change and the only variable constituent is the free silica. It is true that some deposits of feldspar are sufficiently uniform in character so that this method may be applied, but unfortunately there are many deposits which contain extremely variable mixtures of potash and soda feldspars together with free quartz and other deposits which nominally seem to contain only potash feldspar but in which the potash is replaced in variable proportions by soda. Furthermore, most feldspar grinding mills grind material from two or more quarries. Sometimes as many as four or five different feldspars, some of which vary in composition, are mixed and ground together to form a blend. In all of the cases just mentioned a simple silica determination would be of no value, since the ratio of silica to alkali differs in microcline, albite and anorthite.

Unless a feldspar consumer is positive that the feldspar which he is using all comes from one deposit and that the type of feldspar is unusually uniform in this deposit, it would be unsafe and very misleading to depend on a simple silica determination instead of a complete analysis. Since it is not always the practice among feldspar producers to have complete

analyses made of their different feldspars at frequent and regular intervals the potter has no assurance that the type of feldspar which he is using does not change between shipments. If fluctuations in silica content and if the ratio between potash and soda are not seriously objectionable to a potter my objection just stated is of course over-ruled; but one of the greatest objections which I have heard stated by potters to the feldspars which they have received in the past few years has been that it was extremely variable in composition and that this lack of uniformity had occasioned great losses.

The complete analysis of a feldspar is of course a slow and tedious operation but after a thorough study of the subject of analysis and after consultation with ceramists and experienced mineral analysts I have been forced to the conclusion that there are no short cuts which, under ordinary circumstances, can be safely made.

COÖPERATIVE RESEARCH ON SAGGER MIXTURES AND MANUFACTURE[1]

By C. C. Treischel

One of the fundamental reasons for the formation of Industrial Divisions within the American Ceramic Society was the promotion of coöperative research. You have read of the results obtained by the Enamel Division in their investigation of "fishscaling." You have heard of the work which is now being carried on by the Heavy Clay Products Division in their researches on firing problems. The Refractories Division has been engaged in coöperative work for a long time. Other Divisions are falling in line. Is not the time opportune for the groups associated in the White Wares Division to attack some fundamental problems which need to be solved? Does not the spirit of this period, the cry for reducing waste in manufacture, demand some combined effort on our part to strike at the heart of some of the phantoms which have dogged our industry ever since its inception during the middle ages, phantoms which we have all individually attempted to blot out, with at the best, but poor success? I believe that the time and the demand are here and for this reason desire to present for your consideration a research proposition covering one item in our manufacturing expense, an item which in losses is annually costing our industry millions of dollars. This item is "saggers" and our problem is "How can we produce better and longer lived saggers?"

During the past year my work as Secretary of your Division has been chiefly concerned with organization but I have also devoted considerable time considering various problems that have been suggested to me for

[1] White Wares Division, St. Louis Meeting, Feb., 1922.

coöperative research. Among these were raw materials, drying, firing, saggers, glazes, processes, equipment, etc., but the sagger investigation seemed to best suit our demands, *viz.*, a problem of vital interest to *all* of the groups associated in our Division; for only with a vital problem of interest to all the groups could we hope to obtain the coöperation and the financial assistance necessary to carry the researches through to a definite end.

The suggested sagger experiment printed in your programs indicates my personal views of the manner in which a research of this sort should be conducted and some of the points that should be covered. Changes will no doubt be made by those in charge of the work but I believe that these changes will involve additions rather than subtractions.

TABLE I

SAGGER EXPERIMENT SUGGESTED BY C. C. TREISCHEL FOR COÖPERATIVE RESEARCH PROBLEMS FOR THE UNITED STATES POTTERS' ASSOCIATION

LABORATORY

1. Water of plasticity.
2. Drying shrinkage.
3. Firing shrinkage.
4. Compressive strength.
5. Deformation under load.
6. Fusion temperature.
7. Vitrification temperature.
8. Cross breaking strength.
9. Fineness.
10. Experimental mixtures.
11. Effect of rate of drying on strength.

FACTORY

Methods of Preparation

1. Ground clay *vs.* unground clay.
2. Wet grog *vs.* dry grog.
3. Wet pan *vs.* soak pit.
4. Vertical pug-mill *vs.* horizontal pug-mill.
5. Re-pugging.
6. Ageing of body mixture.
7. Short period tempering *vs.* long period for wet pan.

Method of Forming

1. Power press.
2. Hydraulic press.
3. Hand made.
4. Cast.

Firing

1. Loaded and to temperature of ware.
2. Empty to temperature of ware.
3. Empty to above temperature of ware.

I believe that this investigation can be carried through at an expense of $50,000. A fairly accurate estimate which I made last summer showed that we have available in this country the equivalent of 3,000 round potter's kilns in which saggers are used. This includes those manufacturers making art pottery as well as those of our own White Wares industry. From data published in our *Journal* and from personal correspondence I estimate that our annual sagger cost is $20,000,000. If we through coöperative effort could double the life of our saggers, we would save our industry about $10,000,000 per year. If this saving could be made through an expenditure of $50,000 would not the expense be justified?

As a method of raising funds necessary to carry on this work, I would suggest an assessment of twenty or thirty dollars per unit kiln for each manufacturer. By unit kiln, I mean a standard size, say $16^1/_2$-foot diameter. If a potter uses 14-foot kilns then use the ratio 14 to $16^1/_2$ in estimating his assessment.

The foregoing, I believe covers the essentials which should be considered.

Discussion

MR. SEBRING:—It seems to me that the experiment should be done by industrial groups. I don't pretend to know the technical end of the business, but I do know something about the cost of saggers in our industry, and it seems to me that our requirements of a sagger would be much different from the requirements of the manufacturers who fire at a higher degree of heat. The highest temperature we reach is about 8 cone. I am wholly in sympathy with the idea of having coöperative research made in order to determine some way of reducing the cost of saggars. The cost at our factory last year was $3300 per kiln. I make an estimate that the cost on your white ware factories would run about $2500 per kiln. It seems to me that if the general wares were treated as a group, the electrical porcelain as another group, and so on, you would be able to get some place. I am perfectly willing to pledge now the support of our factories to any amount that is required in order to carry on that work, provided it is carried on by groups. If we try to mix up the experimental work of the electrical porcelain along with the crockery, dish manufacturers, they would not get any place. I would like to go on record as pledging my support, however, to the project as suggested by you with my added suggestion.

MR. HUNT:—I agree with Mr. Sebring that the requirements for the general wares group are not the same as for the requirements of the porcelain and like industries, but I think the project can be carried out and progress made. I disagree with him in part. I am of the opinion we would get along all right if we started out on the same basis in our experiment with

the others, but the final results should be carried on by the groups. I think the entire thing should be under a central head, but separate work in each industry.

MR. TREISCHEL:—If this thing were started, I think we would be surprised to find how similar the sagger problems for the various groups in the White Wares Division really are. Considering the basis of our industries as a whole, you will first find, in research, that we will have to deal with fundamentals. It is quite possible that after the fundamentals are established the research will perhaps have to be carried out on a basis of maturing temperature rather than industries. There are a lot of general ware people who are biscuiting as high as the electrical porcelain.

MR. SEBRING:—I do not have the exact figures, but I think there are about 600 kilns in the United States devoted to the making of general ware, and 500 in the making of other ware. All of those 500 fire their biscuit to approximately the same temperature, and it seems to me that if those are treated as one group, you would have something concrete to offer to the members of the United States Potters' Association, and I believe it can be put over. I frankly believe that it would be money well spent if we gave as high as $50 or even $100 a kiln a year for two years, or for as long as it is necessary in order to get somewhere. An assessment of $100 a kiln would mean about a thousand dollars to a factory—approximately $700,000 during a year, yet the cost to each would be very small. That would mean a thousand dollars in order to try and cut down an expenditure of approximately twenty-five to thirty thousand dollars a year—say $100 a kiln as a maximum wouldn't overburden the general ware manufacturers, but in your estimate you say there are 3,000 kilns and cost approximately twenty million dollars a year—that is approximately $6,000 per year per kiln. I am sure that is not the cost of the general ware manufacturers. I do not believe it will run to more than twenty-five hundred to three thousand dollars. But I believe that if you have a definite proposition you would get some place. It is a big problem—it is a problem that we have all tried to solve, even to the extent of using carborundum.

MR. SPROAT:—I think there should be a committee appointed to carry the work on; to investigate the different conditions representing all the White Wares groups.

MR. GOODWIN:—Would not this come under the scope of the work being done by the United Potters' Association Research Committee?

MR. TREISCHEL:—I do not know. I had hoped to get a chance to go over this matter before this came up. I think the chairman of the different research committees should get together. That is the only way the proposition can be given proper attention and representation. Or the representatives of the groups should get together. The thing that the officers of the Division would like to have is a recommendation,

showing the desirability or undesirability of this coöperative research problem. If you don't want it, we won't go ahead. If you do want it we will try it within another year. If anyone wants to put it in the form of a motion, we can put it in the record as a sort of vote of confidence.

MR. SEBRING:—I will be glad to make that motion. I think it is a move in the right direction. I have given my views, and I should like to make the motion—that it is the sense of this meeting that the manufacturers be solicited.

MR. STAUDT:—I think all the manufacturers are interested in getting closer. I said yesterday during the last twelve years I have been trying to find out how to make saggers and I have not gotten anywhere. Now is the time for us to start something.

MR. GOODWIN:—Would it not be wise to ascertain what is being done in New Jersey?

MR. STAUDT:—We have only done just as much as you have—we have been talking about it—that is as far as we have gotten.

MR. SEBRING:—A Research Committee shall be appointed from this Division. I move then, Mr. Chairman that it be the sense of this meeting that we support a recommendation that there be a coöperative movement between this Division and the various manufacturers who are members of this Association for the purpose of trying to solve the sagger problem. The question as to assessment or financing is a detail that can be handled by whoever handles the proposition.

The Secretary:—You have heard the motion, and it has been seconded.

MR. STAUDT:—I second it once more.

MR. TREISCHEL:—You have heard the motion all in favor say "Aye."

The "Ayes" have it and it is carried.

Discussions since St. Louis Meeting

BY MR. A. V. BLEININGER:—I am heartily in favor of a comprehensive study of the subject but I do not think we are ready to proceed at once with actual laboratory and plant studies. In my opinion we should first submit a brief covering our present knowledge of the subject and embodying a critical discussion of previous work. It is not at all unlikely that we already possess important information which will furnish the key to the situation and will greatly reduce the magnitude and expense of the work. It is suggested that either a sub-committee or some individual be delegated to prepare such a report. The outline suggested of work to be done is of too general a nature and we are quite apt to overlook important facts in the mass of testing data accumulated. One of the outstanding needs however is the study of the properties of the commercial sagger clays without reference to specific or special tests. It would be of great service to de-

termine the water content, drying shrinkage, by volume, the burning shrinkage and porosity at different temperatures. This study should not be expensive and would enable us to obtain a clearer idea as to what the sagger clays really are. It is generally realized that such information is not available at the present time. Special studies could then follow this work.

My recommendation therefore is: First, that a survey of the present situation on saggers be made, and, second, that the first laboratory work contemplated be the usual determinations of the properties of sagger clays. It is not unlikely that such work could be done by one of the Federal Bureaus. One of the essential tests I have failed to mention would be the strength of sagger clays admixed with 50 per cent of a standard grog, both in the dry and in the fired state, without reference to the resistance of the materials to load conditions at furnace temperatures.

By Herbert Goodwin:—This subject is one, as we all realize, that calls for study and research which we hope will be taken in hand by the research committee of the organizations interested, yet it would seem to me that a few practical suggestions would be helpful in solving this very vital problem.

Without a doubt, the mixture of sagger clay bodies and the making of a sagger are equally as important as the making of the ware which is to be fired therein, and yet up to this time so little progress has been made in this direction, due in a large measure to the fact that in the building of the potteries, the Sagger Department has been one to receive the least consideration; often cramped in some small quarters so that it could be considered a sagger shop and at other times so imperfectly equipped as to be of no use for the purpose intended. To make a perfect sagger is undoubtedly a problem very difficult to solve, but the first step in this direction after determining the best clays to be used for the purpose would be to weather; secondly, after doing so to wheel them into a drying room where the different clays could be accurately weighed and mixed in their proper proportions with the grog. The latter would have to be determined in a large measure by the use of the different clays. Some clays would permit of some fire clay, others with fine grog, others with the fine grog eliminated, and grog of one eighth mesh. There is only one way to solve this problem and that is by the aid of the Research Committee.

To state at this time the clays which have proven most satisfactory in my experience would be unwise, as it would be better to leave these to the investigations which we hope will be made. As stated by Mr. Hunt saggers which could be used with good results in a semi-porcelain factory would not be so successful in the manufacture of Vitreous China or Tile, as the sagger which is bedded with sand with the ware must have allowances made for the expansion and contraction in cooling which is not necessary with semi-porcelain ware. The study is a very interesting and deep one.

DISCUSSION ON "THE ADAPTABILITY OF THE GAS-FIRED KILN FOR THE BURNING OF CLAY PRODUCTS"[1]

By R. H. Minton:—Mr. Richardson has clearly stated the comparison of the compartment type of kiln as compared with the old periodic type of kiln and the modern railroad tunnel kiln. The strong claim of the promoters of the railroad tunnel type of kiln has been the great saving of fuel as compared with the periodic type of kiln. This saving is accomplished through the ware in the kiln being subjected to direct firing for a short period of time only, due to preheating the ware to a fairly high temperature by the off-going products of combustion, and in addition a considerable amount of heat from the cooling ware is recovered and usefully employed in the burning of the fuel by the preheating of the air for combustion. Exactly the same cycle of operation is employed in the compartment kiln inasmuch as the off-going products of combustion from the chamber fired directly is passing through the chambers ahead, preheating the ware, and the air for the firing of the fuel in the chamber directly fired is preheated by passing through the chambers cooling, thereby cooling the ware and at the same time obtaining the benefit from the highly heated air which shows a corresponding saving in fuel.

The tunnel kiln requires an exact setting of the ware on the trucks to obtain a uniform circulation of heat, but the compartment kiln can be set by any of the known and employed methods in the periodic kiln and still obtain the same remarkable uniformity of temperature throughout the compartment which is of the greatest importance in all cases where a variety of materials are being manufactured. Therefore, the compartment kiln has all the advantages of the tunnel kiln and still allows operation within wide limits. Furthermore, the compartment kiln permits of longer heating and cooling periods which is so essential in the firing of a great variety of ware and will allow of a compact kiln without impairing the firing capacity of the kiln. To obtain similar results with the tunnel type of kiln would require a kiln of enormous length which often does not fit in with the best factory construction. So far as I know, there has never been made any direct comparison of the fuel consumption of the tunnel type of kiln with the compartment chamber kiln. It is doubtful whether the former will show any advantage whatever over the latter in the matter of fuel consumption.

The compartment type of kiln originated in Germany and has been confined almost exclusively to the firing of brick. It has been adapted only to a very limited extent for the firing of other types of ceramic wares. At the former Royal Berlin Works, there is a small compartment kiln of 22 chambers which is used for the firing of hard porcelain. This, of course,

[1] W. R. Richardson, *Jour. Am. Ceram. Soc.*, **5**, 254 (1922).

is a very small kiln as compared with the Hoffman, and similar kilns used for firing brick.

Within the last four or five years, there has been developed in England, a compartment kiln known as the "Shaw Gas Kiln," which has been especially designed and adapted to the firing of the finer grades of ware as well as brick. This is a kiln consisting of 16, or more, chambers, fired with producer gas. At the present time there are two in operation in France and 21 in England, while a number of others are in process of being built. During the past three or four years, the General Ceramics Company has experimented with practically every type of tunnel kiln in the firing of fire clay sanitary ware. None of the trials that were made proved successful, although it can not be said definitely that they might not have been successful under different conditions. However, after investigating every type of kiln, the conclusion was reached that the Shaw kiln was better adapted to this class of ware than any other type so far developed. At the present time two of these kilns are being built in America—one for vitreous sanitary ware and the other for fire clay sanitary ware.

This kiln is now being operated in England for the firing of enameled brick, fire brick, glazed wall tile, architectural terra cotta, vitreous sanitary ware, fire clay sanitary ware, fancy art ware, high-grade pottery, electrical porcelain, general dinner ware and various kinds of bricks, including silica brick. The kiln is being used for the various articles for both the biscuit and glazed firings. In fact, it has been used for practically every type of ware except salt glazed ware.

The operation of this kiln is remarkable for its elasticity, as it may be made to fire quickly or slowly on account of the firing being under absolute control. For this reason it is possible to fire different kinds of ware at different temperatures in the different chambers. On account of the control of the firing, it is possible to regulate the atmosphere of the burning chamber to produce either oxidizing or reducing conditions, as desired. It has been found possible to fire glazed ware without the use of a muffle or sagger on account of the freedom from sulphur, smoke and ash. In firing the kinds of ware which require saggers for placing, it has been found that the life of the sagger is from three to five times as long as in the ordinary kiln.

On account of the ease of operation and the use of a gas producer, the amount of labor in connection with firing this kiln is remarkably low. It has been demonstrated that one man is quite able to handle the firing of the kiln during any shift. The labor of handling the coal and ashes is very remarkably reduced because of the great economy due to perfect fuel combustion. It has been found that the temperature of the burning gases as they pass into the stack are about 100 to 150° centigrade and that all smoke is consumed in the combustion chambers.

The fuel economy in connection with the operation of this kiln seems quite remarkable and in some cases almost beyond belief. In connection with the firing of fire clay sanitary ware, it has been found that the coal consumption amounts to about 15% of what is required for firing of periodical kilns which are believed to be operated quite efficiently. This, of course, is a very remarkable saving. One of the reasons for this is that it is possible in this kiln to fire glazed ware without the use of a muffle, resulting in a very great fuel saving aside from the more complete combustion of gases and the use of the waste heat. This same saving of fuel has been noted in connection with the firing of the various kinds of ware which are being fired in this kiln. For instance, fire brick fired to cone 10 have required a fuel consumption of 400 lbs. per thousand bricks. As the English brick are 3″ thick as against $2^1/_2$″ for the American brick, this consumption would be slightly less in America. For terra cotta ware, the consumption of coal has averaged about 17 tons per 100 tons of ware.

On account of the uniformity of the temperature in each of the chambers and the control of the gases, it is possible to obtain a higher quality of product than is usual with the ordinary kiln. The combustion air passes through six (6) chambers and the heat from the chamber being fired, also passes through six (6) chambers. In a kiln of 16 compartments, this leaves four (4) chambers free for setting and discharging. The actual fire time varies with the class of ware and ranges from 10 hours for table ware glost to 24 hours for heavy fire clay sanitary ware. The firing time governs the number of chambers that may be discharged per week, ranging from 7 to 16 chambers. On account of the preheating of the chambers, the firing and cooling curves are remarkably uniform. resulting in great economy of fuel and remarkable uniformity of quality of the ware throughout the chamber.

As soon as the kilns now being built are completed, an opportunity will be presented for acquiring data on their operation as compared with tunnel kilns and periodic kilns. There is no doubt but what the compartment type of kiln will receive more attention in the future in connection with the firing of all types of ceramic wares.

DISCUSSION ON "LAMINATIONS, DISCUSSION OF CAUSE AND CURE"[1]

By R. B. Keplinger:—Mr. Brand's nomenclature and definitions applying to the two forms of lamination seem to meet all requirements. The local terminology for these two types is "differential" and "auger" lamination, for which latter the term "interfacial" is probably more inclusive and broader in description.

It is believed, with Mr. Lovejoy, that distortion of the clay blank in the

[1] *Jour. Am. Ceram. Soc.*, **5**, 355 (1922).

mould box under pressure of the repress plunger simply serves to intensify the separation of the clay along the planes of the laminae already included in the blank—if even this is the case, which our experience has gone far to disprove. In paving brick manufacture it is mainly desired to remedy the extreme type of differential lamination, which is generally more marked at the ends of the block than on the top and bottom surfaces, as of course the ends are already the weakest portion structurally of the block unit. The familiar herring-bone evidence of interfacial lamination, when present in marked degree, is usually so far in the interior of the block that the grind of traffic or the abrasion of the rattler will not discover a structural weakness. Fairly consistent evidence can be cited that repressing actually tends to "heal" or reunite the laminated surfaces at the ends of the block and while holding no brief for the repressing process we have less difficulties securing sound ends manufacturing repressed block, than straight wire-cut or bulged end block. This of course applies only to this material, a fairly gritty shale. Furthermore, in burning, the ends of the block exposed to the impinging action of the flame, creating differential shrinkage strains, will show intensified lamination when compared with thoroughly vitrified ware from the lower middle courses. These latter are subjected to the very considerable weight of the upper courses, which tends again to heal these lamination planes when heated to incipient viscosity in the course of the burning.

I do not quite agree with all Mr. Brand says about die lamination and the action of the clay in the nozzle and die of the machine. Mr. Claude Fuller's experiments at Buffalo, Kansas, using a well known standard make of paving brick machine, first convinced me of the soundness of the "interlocking cone" theory of clay bar structure. He demonstrated this, quite ingeniously, by painting a cross section of the clay at the throat of the machine and then replacing extension and die; he ran the bar out, dried it and carefully dissected it to uncover the painted surfaces. This of course would not demonstrate the action of the auger upon the clay except subsequent to the clay passing the point of the auger. It was found necessary, at Buffalo, to reduce the taper of the nozzle and slightly extend its length, thus reducing the friction and resistance to the passage of the clay, producing a shorter "cone" length and lessening the differential flow. We have demonstrated this, at least to our partial satisfaction, after experimenting with various combinations of nozzles, extensions, dies and augers. When one considers the fact that on a great many paving brick plants the passage for the clay is reduced from a fifteen-inch auger diameter to the rear opening of the die whose finished size is approximately 4 inches by 9 inches, in a lineal measurement of but a few inches, it is almost impossible not to conceive of the tremendous differential stresses involved.

In endeavoring to remedy this differential flow the experimenter is lim-

ited by the design of the standard type of machine. To approximate a straighter nozzle one must reduce the diameter of the tapered nozzle at the larger end. This reduces the wing surface with respect to the size of the hub, so we must have smaller hubs, hence smaller shafts. If we can go this far we find we have a greatly reduced capacity. This can be remedied by speeding up the R.P.M. or by increasing the pitch of the augers and propeller whether of single or double wing type. At this point it will probably be profitable to scrap the machine and re-design one to suit the requirements.

At the present time I have before me a blue print showing the nozzle lengths, and reduction in diameter of these nozzles from rear to discharge end, of twenty-two standard brick machines with which paving brick can be made. These nozzle lengths vary from one foot to twenty-eight inches, and the reduction in diameter shown by these nozzles runs from three inches to thirteen inches. Yet all of these machines are supposed to be capable of turning out A–1 paving block from shales having similar properties and qualities.

Whether, by returning the clay to the machine often enough, differential lamination will disappear, appears rather doubtful and extremely difficult of proof. Mr. Brand's assumption that by increasing the lines of cleavage until it is impossible to further subdivide the clay layers, he will secure a clay which for all intents and purposes, will be non-laminated and with a lower plasticity, might hold if the cleavage planes and layers of clay ran in the same direction and were superimposed with each journey through the machine. Otherwise it would seem to be necessary to run it through an infinite number of times. My experience has been that when our material has been run through more than two or three times it is unfit for the manufacture of paving brick. I agree that increasing the distance between the die and the auger will help to eliminate auger or interfacial lamination in gritty clays; but have also found that it increases the differential flow. This is more clearly emphasized by the large increase of power consumption when this dimension is appreciably lengthened. It would be perfectly possible, theoretically, to arrive at a certain distance of the die from the auger, at which distance it would be impossible to apply sufficient power to the machine to operate it, without wrecking it.

Mr. Brand's theory of occluded air must certainly be received with respect. It furnishes a reasonably satisfactory answer for many obscure results, such as the "bulge" or swelling of the column at the die. As to whether the blisters that form on the surface of the column of clay are due to the expansion of occluded air or to other internal strains or stresses within the bar, causing a surface lamination which, released from confinement of the die, or due to incipient surface drying, cracks or bursts open, I can hazard no conclusion.

DISCUSSION "NOTES ON DIAGNOSING CAUSES OF CORDS IN GLASS"[1]

By F. Gelstharp:—Any devised method of diagnosing defects in glass which goes beyond the possibilities of chemical analysis is deserving of much credit even if it gives nothing more than a suggestion as to the cause. Mr. Twyman by means of optical methods enables the chemist to obtain certain properties of the particular defect known as cords, which may in some cases lead the way to their elimination.

Cords have always been considered as a glass varying more or less in composition from that of the general mass. And my experience has been that a chemical analysis of the cord and surrounding glass compared with that of the glass free from cord will show an excessive amount of alumina and silica sometimes associated with an excessive amount of lime, but in the latter case it has often been traced directly to localized impurities in the limestone, whereas, where the lime content corresponded with the alkali, the presence of cords has been due to solution of clay, no doubt originating from the furnace or tank walls, entering the glass as a drop from overhanging clay work. Often such drop formed cords are colored more or less by impurities in the clay. I have generally been able to diagnose the cause of cords by making painstaking chemical analysis, and I personally welcome the rapid optical methods described by Mr. Twyman as they provide further data which would help one to draw the right conclusions, in many cases making it unnecessary to obtain a chemical analysis. And where the cord was very slight (in which case a chemical analysis would be unsatisfactory). The optical method would at least give some clue.

DISCUSSION ON "MICROSCOPIC STUDY OF GROUND COAT AND COVER COAT ENAMEL REACTIONS"[1]

By B. T. Sweely:—Mr. Geisinger has opened a new field to investigation in the enamel industry. I think the author is to be congratulated on his very careful work and on the very able preparation and presentation of the data contained in this paper.

Unfortunately, Mr. Geisinger's results and conclusions are not applicable to the sheet steel enamel industry, directly. His work has been confined entirely to the fishscaling and shivering of finish enamels as we know them, and not to ground coats and grey ware or one coat enamels.

Light steel, such as is used for cooking ware, etc., usually will not fishscale badly, after the second coat of enamel is applied, probably because sufficient strength is secured in the two coats to resist the stress set up by

[1] F. Twyman, *Jour. Am. Ceram. Soc.*, 5, 289 (1922).

[2] E. E. Geisinger, *Jour. Am. Ceram. Soc.*, 5, 322 (1922).

the contracting steel. Further, most of such ware, being enameled on both sides, is further protected against failure in the characteristic fishscale form, by the fact that after the second coat of enamel is applied, there are in reality four coats of enamel to resist the stress set up by the greater contraction of steel over enamel, and consequently failure or fishscale seldom occurs on such ware in the second coat.

In enameling heavy plate, however, such as was used by Mr. Geisinger in his work, it would seem quite probable that fishscale would occur after the second coat was applied, as a very heavy steel is used and the enamel applied to one side only, the finished piece having far from sufficient enamel to counteract the stress set up by the contracting steel.

From the above, therefore, it would seem that Mr. Geisinger is dealing with and speaking of an entirely different set of conditions than those that were under investigation in the work of Danielson and Souder. The latter writers were working with thin sheet, from 22 gauge to 28 gauge steel, enameled on both sides, with but one coat of enamel, and the fishscale encountered in their work occurred in this one or first coat of enamel and not in a subsequent cover coat, and it is with this type of failure of ground coats or grey coats that the enameler usually has to contend, and not of the finish enamels. It would be interesting to know whether Mr. Geisinger has ever experienced fishscale to any great degree in his ground coats, and if so, whether the same conditions obtain in regard to the enamels resistance to fishscale as was observed in his work on cover enamels.

It has been the writer's observation, that bubble formation in ground coat enamels is very prevalent, in fact under even a low power glass, most ground coats reveal a very large number of minute bubbles, and it might well be that this bubble structure, or the lack of it, plays an important part in the fishscaling of first coat and grey ware enamels under varying conditions.

Aside from its effect on the fishscaling of finish enamels as Mr. Geisinger has so nicely shown in this paper, it has occurred to me that this bubble structure in finish enamels might play an important rôle in the resistance of kitchen ware, to thermal shock and impact. I should be very much interested in hearing from the author of this paper, whether he has ever investigated the possible relation of this structure of finish enamels to the above mentioned physical properties of enameled steel ware.

DISCUSSION ON "PAINTING IN UNDERGLAZE COLORS ON THE BISCUIT"[1]

By Paul E. Cox:—1. In Mr. Rhead's paragraphs dealing with mediums, under the heading "Painting Mediums," sub-head "Water" he

[1] F. H. Rhead, *Jour. Am. Ceram. Soc.*, **5**, 376 (1922).

notes the trouble with dusting, or rubbing of the color. It has come to my attention that one well-known studio pottery overcame this trouble very satisfactorily, in fact with entire success, by quickly dipping the painted piece into clear water just before dipping in the glaze. This set the color so that it did not wash off in the glaze, though likely enough a little was lost in the water dipping, and a trouble with "crawling" of the glaze was stopped, this "crawling" being due to the dust of the color in the thicker deposits of color. It may be noted that a little gum tragacanth had been used in the under glaze color as originally applied.

2. Under the heading "Use of Underglaze White" mention might be made of the use of a dark clay made white on the surface only by the use of a suitable engobe. Such a surface is good for underglaze painting on the unburned piece or on the biscuit, as is desired. It ought to be possible likewise to borrow from the Collected Writings of Dr. Seger, and to make use of a white ground in the form of a tin enamel, carrying the underglaze colors, the colors being covered in turn by either a clear glaze or a translucent glaze, as desired. Seger spoke of two clear glazes being so used.

3. Under the heading "Preparation of Surface for Painting" the plan followed at Newcomb Pottery for the preparation of a surface might be followed in addition to those plans enumerated. The leather hard piece is carefully sponged so that the texture lines take the direction desired by the artist, doing away with a difficulty where thin washes are used that manifests itself in streaky looking work. It is probable that experiment would reveal a number of ways of securing textures that would yield special results and secure desirable effects where light washes are used. The air brush is of course a method, where even grounds are wanted.

4. In Table I, the use of zinc oxide in both the French green and the olive green strikes one familiar with the usual effect of zinc on greens obtained from copper and chromic oxide as a thing to be studied. In ceramics no one can say a thing is impossible but this is unusual.

5. In Table III zinc oxide again appears but in relatively small amounts. The suggestion might be made that the borates offset the effects of zinc oxide in the several cases. Mr. Rhead does not indicate what the fritt proportions are in his glazes, and it will be noted that these glazes are English in origin. This is not to say that they are not good glazes on that account, but a paper of this sort appeals to the amateur as well as the professional potter, and it might be well in another paper to point out how these glazes might be made up from American materials only. It is to be supposed that the borax is in such small amounts that it functions as a soluble salt, but the ground glass is not stated as to composition. Since no bodies are named on which to make use of these glazes it might be worth while to specify all raw materials, about which there might be doubt.

6. In the use of Liquid Underglaze Colors is it possible to make use of

organic dyes as a help in application of the colors? Newcomb Pottery, acting under a suggestion from the writer, makes use of carbonate of copper as an underglaze green, and as this is a precipitated material this has proven a very satisfactory underglaze color. Doubtless other precipitated mineral salts would prove equally satisfactory.

7. For the amateur a description of the process of ground laying used in the white ware industry would be of interest, reference being made to that process where cotton pads are used for the application of dusty color to an adhesive coated surface.

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of the

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A Monthly Publication Devoted to Proceedings
of the Society, Discussions of Plant Problems, Discussions
of Technical and Scientific Questions and
Promotion of Coöperative Research

Edited by the Secretary of the Society Assisted by Officers of the Industrial Divisions

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Vol. 1 August, 1922 No. 4

EDITORIALS

CONVENTIONS

The American Ceramic Society is planning for three conventions to be held in the immediate future: (1) Summer Excursion Meeting the week of August 13; (2) Ceramic Day at National Exposition of Chemical Industries the week of September 11, and (3) the Annual Meeting, in this instance the twenty-fifth anniversary, the week of February 12, 1923. Do these "get togethers" pay dividends commensurate with the invested time and money of those who attend?

Many hundred conventions are held each year. All sorts of mercantile, manufacturing, agricultural, professional, educational, scientific, political, social and fraternal groups meet at least once a year and some of them more often. Committees of all sorts hold frequent meetings, the members often traveling long distances at large expenditures of time and money. Are the benefits derived from attendance at conventions and committee meetings commensurate with the costs to the individuals and to the concerns which these individuals represent?

Rather than evaluating these benefits it is sufficient for the purpose at hand to consider only the circumstantial evidence to prove that attendance at conventions must repay more than the monetary equivalent of time and money expended, or the attendance at conventions would not be constantly increasing, and there would not be such a remarkable in-

crease in the number of conventions each succeeding year. Convention bureaus, reporting agencies and convention journals find an increased demand for the peculiar service which each renders. Conventions have been recognized as business, political, educational and social necessities. An increasing investment in conventions by the leaders in every walk of life bespeaks the solid values enjoyed by those who attend.

Summer Excursion.—The Summer Excursion Meeting of this Society which is routed from Rochester, N. Y., to Montreal, Buckingham, Ottawa, Verona, Kingston, Toronto and Hamilton will have a peculiar value for those who attend in (1) broadened and intensified acquaintance with fellow ceramists; (2) mutual exchange of experience and information on manufacturing problems; (3) increased knowledge through inspection of manufacturing plants and feldspar quarries; (4) cultural advantages of travel to cities of individual and universal interest; (5) cultural benefits of acquaintance with persons who have accomplished important work; and (6) an invigorating outing on lake and river, through some of nature's most beautiful and most thrilling scenes, and to places that range from the most sophisticated cities to the backwoods camp. Such a wide variety of benefits is seldom obtainable from conventions as is offered by this Summer Excursion Meeting.

Chemical Exposition.—The convention in New York City in connection with the National Exposition of Chemical Industries is well established as an occasion of profit to those who attend. It is sufficient in this writing to say that our program committee under the leadership of Mr. R. D. Landrum and the secretaries of the several Industrial Divisions of the Society is planning a day of interest and value. The Exposition is a broad educational institution well worth the time and expense of a thorough study by ceramists.

As for our **Silver Jubilee Convention** next February in Pittsburgh, it will be the biggest meeting in the interest of coöperative Ceramic Research yet held. The Divisions and Committees are making plans for a potent occasion for advancing the ceramic arts and sciences. The Charter members are planning to renew the spirit of a quarter century past which prompted them in the face of industrial opposition to begin this mutual exchange of knowledge and coöperation in investigation of unsolved problems. The younger members are planning to show the results of present day broad-minded and hearty participation in cooperative research.

Ceramic workers can ill afford to neglect the advantages offered by these well planned conventions. It is expected that a goodly number will attend each of the three meetings now scheduled.

SERVICE AND COST

A Chat with The Secretary

Increased Service at Less Cost.—The recent numbers of the Journal have been remarkable in several respects. The increase in number of original papers and discussions, and of abstracts of the world's literature is self-evident to the casual observer but few we find who have observed the greater length and width of the printed column on each page, by means of which the amount of reading matter per page is increased more than 26 per cent. If the printed matter in the April number had been in this wider and longer column it would have needed only 66 rather than 88 pages.

Savings Are Re-invested in More Service Rendered.—We wish to stress the point that this 26 per cent greater capacity column gives a net saving per material printed, which saving is re-invested in more printing. It is this sort of economy in the interest of the subscribers that the Committee on Publications is studying so as to give even greater returns for membership subscriptions.

Scientific management and cost systems have been worked out for printers with resultant fixed scale of charges which makes the working tools of the Society cost much more now than they did before the war. This in turn calls for closer managing on the part of the executives of the Society, and, even with close managing, expenses cannot be met without the assistance of the members.

Expenses Have Increased but Membership Dues Have Been Kept Low.—The officers of the Society are constantly striving to give more and more service without increasing the annual subscription, but even with the most thrifty shopping for the working tools, the officers are at all times confronted with the fact that there are only seven hundred and fifty cents in each personal subscription. This Society is unique because the low personal membership dues have been maintained in spite of the increased cost of everything.

Journal Published at a Loss.—In the year 1921 the Journal, though small, was published at a loss of over $5,000. The exact figures are given in the Year Book. This year the executives of the Society courageously trusted to the coöperation of every member and to the far-sightedness of corporations, in their decision to issue an even larger and more costly Journal, on the grounds that such was absolutely necessary if the Society was to assume its just obligations in these days of more earnest seeking for technical and scientific information. They assumed that persons interested in ceramics and in their own welfare would secure additional subscribers to the support of the greater service thus rendered. These expectations have been realized to some extent and it

is confidently expected that the full quota of required new members will be secured just as soon as the members realize the larger advantage that accrues to each individual and to each corporation from a more virile and productive organization.

Importance of Greater Membership Support.—Self-evident should be the greater things which could be accomplished when the membership is brought to the full strength required for this Society to meet its obligations in the more aggressive coöperative research program on which the ceramic industrial groups are now engaged. The Trade Associations, the Trade Journals, the Federal Bureaus, the Universities and the manufacturing concerns need this central organization devoted solely to technical and scientific research. They are coöperating agencies each engaged on its special problems but each dependent upon the American Ceramic Society, as upon each other, to have sufficient strength and be sufficiently productive to work into a unit structure the results obtained by them and by individuals so that each may have the benefit of information obtained by the others on the many things that are of common concern.

The executives will continue to plan ways and means of obtaining the most for those who join in support of this Society, but the most urgent thing right now is the presentation to many others that it is not only their duty but their opportunity to share in the support of this work.

If you are of the belief that your membership support is a good investment for you, why not increase the value of your membership by inviting others to share in the returns. This is the only way you can receive greater service at the same cost.

EDWIN WARD TILLOTSON, JR.

Edwin Ward Tillotson, Jr., a recognized authority on the chemistry and technology of glass, and Assistant Director of the Mellon Institute of Industrial Research of the University of Pittsburgh, was born at Farmington, Conn., on February 28, 1884. He received his professional chemical education at Yale University and was graduated in 1906 with the degree of B.A.; in 1909 he received the degree of Ph.D.

Following the completion of his graduate work at Yale, Dr. Tillotson joined the Department of Industrial Research of the University of Kansas, where he remained for four years as an Industrial Fellow. In 1913, he came to the Mellon Institute of Industrial Research as Assistant Director. The scientific investigations carried out by Dr. Tillotson at the University of Kansas related to a study of the relation between the optical properties of glass and its chemical composition. The scientifically important results

of this research were published in a series of six papers in *The Journal of Industrial and Engineering Chemistry* (1911–12). His recent publications include:

Etch figures, *J. Ind. Eng. Chem.*, **9**, 937 (1917).
Molecular Compounds, *J. Amer. Ceram. Soc.*, **1**, 76 (1918).
The New Factory of the Monongah Glass Co., *J. Amer. Ceram. Soc.*, **4**, 3–24 (1921).
Putting the Glass Industry on a Scientific Basis, *Chem. & Met. Eng.*, **23**, 461 (1920).
Waste in the Glass Industry, *Chem. & Met. Eng.*, **25**, 437 (1921).
The Manufacture of Constructional Glass in the United States, *J. Soc. Chem. Ind.*, **40**, 155 (1921).

Dr. Tillotson is now in supervisory charge of all the Mellon Institute investigations in the field of ceramics, in addition to other research work of the Institute.

Dr. Tillotson is an active member of the American Chemical Society and of the American Ceramic Society. He is a past chairman (1920) of the Pittsburgh Section of the American Chemical Society and at present is a member of the Council of the Society.

Dr. E. W. Tillotson, Vice-President American Ceramic Society, Asst. Director, Mellon Institute of Industrial Research, Pittsburgh, Pa.

In the affairs of the American Ceramic Society he has held the following appointments:

Committee on Publications, 1919–.
Secretary of the Glass Division, 1919–1922.
Vice-President, 1922.
Amer. Ceram. Soc. representative on A.S.T.M. Committee D-10, 1922.

ACTION OF REFRACTORIES UNDER LOAD CONDITIONS AT HIGH TEMPERATURES

The "load test" is now used in all countries and is considered one of the most important in the testing of refractories. Very few there are who know when and by whom it was devised and first used, hence this note of acknowledgment.

The action of refractories under load conditions at high temperatures was first studied by Lemon Parker and reported by him in a paper before this Society in 1905. This test was developed and refined by Professor A. V. Bleininger in subsequent years but the credit for the basic conception

belongs to Mr. Parker. We are pleased that we can make this acknowledgment of credit as belonging to one of our fellow members while he is yet active in the affairs of the Society.

Mr. Parker has been engaged in the manufacture of fire-clay refractories since 1886, serving in various capacities in the Parker-Russell Mining and Manufacturing Company. He was made President and General Manager in 1915.

It was in 1902 that this company was forced to use a high alumina clay in substitution for the silicious clays which they had been using in bench tiles. The situation demanded the adoption of tests that would involve the critical service factors, and which could be quickly executed with reliable results. This caused Mr. Parker to invent the load test.

SURVEY OF SIMPLIFICATION NEEDS TO BE CONDUCTED BY AMERICAN ENGINEERING STANDARDS COMMITTEE

At the request of Secretary Herbert Hoover, of the Department of Commerce, the American Engineering Standards Committee will undertake at once a canvass to determine what simplification in manufactured products is most needed and most desirable. This canvass will be conducted through the engineering and technical bodies having representatives on the Committee or coöperating in its work. The survey of simplification or standardization needs and possibilities will extend into almost every industry in America.

This assignment to the American Engineering Standards Committee is one of Secretary Hoover's steps to retrieve for American Industry a few of the many billions of dollars wasted annually, as revealed in the report on waste in industry which was made not long ago by a committee also appointed by Mr. Hoover while he was chairman of the Federated American Engineering Societies. The latter committee found that waste in industry was due largely to an overmultiplicity in number of products as well as to inefficiency in process.

Of equal significance is the fact that Mr. Hoover's request that the American Engineering Standards Committee conduct this survey and the acceptance of the assignment by the Committee indicate a coördination of the work in the simplification of manufactured products, sponsored by Secretary Hoover, and the work of the American Engineering Standards Committee in the unification of standards on a national basis.

What should be the relationship between the simplification work of the Department of Commerce and the standardization work of the American Engineering Standards Committee has been the subject of considerable discussion. It is clear now that there will be no duplication or overlapping. There seems to be general recognition of the fact that simplification of

product and improvement of process are to a large degree only other words for standardization: that they are standardization put to work. The joint movement for standardization and simplification may, therefore, be said to have begun its work in its own household by standardizing, simplifying, and unifying its own machinery and processes.

The Executive Committee of the A.E.S.C. has, by resolution, pledged the coöperation of the Committee to the Department of Commerce. Representatives of the Committee recently held a conference on the subject with Mr. Hoover at Washington. Subsequently an arrangement was made for permanent exchange of representatives between the two organizations so that there may be the closest possible coöperation between the Commerce Department's Division of Simplified Practice and the American Engineering Standards Committee.

THE EVOLUTION AND DEVELOPMENT OF GLASS HOUSE EQUIPMENT

By J. S. Herzog

ABSTRACT

This paper is an account of the evolution of machinery used in glass-making in which the modern methods are contrasted with the old. *Gas producers, gas burners* and *oil burners* are discussed. In burning gas a greater efficiency obtains when the air entirely surrounds the gas stream as it enters the fire box. In burning oil the high pressure costs more for installation but is more efficient. The tendency is towards automatic machinery for all glass-making operations. Many machines are well nigh perfect but improvements are being made constantly. Mention is made of the need of a better alloy for metal molds. In the glass industry labor represents on the average 40 per cent of the cost of the product. In this respect the glass industry ranks thirteenth.

While glass-making is one of the oldest of the manufacturing industries, it is also one of the newest from a basis of the development of manufacturing processes. Authorities differ as to the origin of glass, but it is very probable that the Egyptians were the first manufacturers in a commercial way. They made glass by a primitive process between 1600 and 1500 B. C.

Geographically and chronologically in the line of development we might list glass manufacture thus: Egypt, Rome, Venice, Germany, Bohemia, France, England, and the United States.

While the ancients produced a great variety of glasses, some of which we have not been able to duplicate, the greatest development in the handling and forming from a purely commercial view-point has been during our time. Due credit must be given them for the processes used as many of our most modern methods are but improved application of those processes.

Pressing glass by means of metal forms was known to the Egyptians; glass replicas of their coins of the time of Thebes have been found. The exact origin of the blowpipe as used in glass manufacture is unknown. It is sufficient to say that it was first used by the Egyptians the second or third century B. C. The application of these two very old processes form the basic foundation of our present day equipment in the shaping or manufacture of glass articles.

Up to the latter part of the last century these processes and their application were but slightly developed. The medal for progress made in the evolution of glass factory equipment for both hemispheres during the past fifty years, belongs without a question of doubt to this wonderful country of ours. The use of gas for fuel has been the greatest factor in this development.

This paper proposes to cover in general, and in many instances in a detailed way, equipment adapted for the glass factory, for fuel, raw material, melting, shaping, tempering and finishing—that is, grinding, polishing and decorating.

In the old days, when wood was the principle fuel used, glass factories were built in or near forests. The locations of our present factories were primarily determined by the fuel supply. After wood, coal, natural gas—and with the exhaustion of natural gas, coal again—have been the dominant factors in the location of glass factories.

With the depletion of natural gas, gas producers and the use of fuel oil have made it possible for glass plants to continue in their original locations. Gas producer plants are of two principle types, raw and washed gas; the latter is the more complete, although the former is the more common type used for glass-making. There are many types of raw gas producers on the market, essentially similar in their general design, differing principally in the degree that they are automatic.

The success of any installation, as to obtaining results at the point of combustion, depends largely upon the arrangement and operation of the tunnels, pipes, dampers and valves. Beginning with a steel or brick tank fired by wheelbarrow and stirred or stoked with a long iron rod, we find today producer plants alone costing many times the former price of a complete glass plant.

Coal arrives at the plant in hopper bottom cars, dumped into surface receiving hoppers, from there conveyed by bucket or belt to the crusher and by the same means to storage tanks over the producers. From these tanks the producers are charged by gravity automatically through the receiving head of the producer. Some part of the producer rotates around a vertical axis. This causes the necessary operation for the stoking or raking and cleaning of the fire. The ashes are automatically cleaned away from the lower part of the producer and conveyed to the dump or storage. The entire process requires one man who manipulates the levers and pushes the buttons.

Several types of raw gas burners have been developed. These burners provide for the mixing of air with the gas as it enters the fire box. Volume air is blown either through or around the gas discharge. The more efficient seem to be so constructed that the air entirely surrounds the gas as it enters the fire box. These types differ only in the places where the air and gas enter the burner and the method of controlling their flow.

Crude oil for glass manufacture is comparatively a new fuel. At present there are two distinct methods used in the industry. Crude oil must be gasified or atomized for successful combustion. The two methods apply to the atomizing process. The common method and the one having the lesser cost of installation consists in atomizing the oil by compressed air at the burner. The oil burned by this method is conveyed by gravity or low pressure pumps to the burner. Fuel oil that reaches the burner under an extremely high pressure is the other method. The pressure back of the oil at the burner atomizes it. The high pressure method

has a higher installation cost, but so far has proven more efficient and economical.

In both methods, whether the oil is stored under or above ground, due care must be exercised in the installation of the system, particularly in the colder districts, and provision must be made for the warming of the oil by the use of steam pipes, both in the storage tanks and the conveying lines. Heat increases the fluidity of the oil and facilitates its handling.

There are a great number of burners on the market, most of them for the more common method of atomizing by compressed air applied at the burner. They differ in their construction only in the method of receiving and distributing the oil and compressed air, and their manner of control. All burners for this method should be provided with facilities for cleaning.

The old glass manufacturer had but one fuel problem—to get his wood cut and hauled to his plant. It is not an infrequent sight in the depleted natural gas districts, to see glass factories equipped with three burners on the tanks and lehrs, for raw gas, natural gas and fuel oil. Two conditions govern as to which is in use, supply and cost.

The handling of raw material has developed with the other departments of glass manufacture, while the wheelbarrow and the hand-shovel are the only raw material handling equipment available in many glass factories, the larger and more modern are supplied with automatic equipment. As raw material for many factories is received in box cars, the power shovel is used to unload cars into hoppers from which it is conveyed to the storage tanks by belt or bucket conveyors. These tanks are circular in cross section, with capacities for from three weeks to ninety days normal consumption. There is a tank for each kind of raw material, and sub-divided tanks for materials whose consumption is not so great. These tanks are made of steel and cement. The poured cement tanks seem to be more satisfactory owing to their lower cost of upkeep. Passages are provided under these tanks either for batch mixer car or belt conveyor. The modern factory where economy and quality are desired, should have its cullet crusher, batch mixer and separator.

Quoting from an authority on glass manufacture, "All materials should be reduced to a pulverized condition. There should be a thorough admixture of the batch. By reducing all particles to their finest possible condition, while in a raw state, a closer mechanical association is affected and they expose more surface to all reducing influences, effecting an earlier fusion of particles and a closer combination of results. A thorough admixture of materials is necessary so that *in* the chemical association each particle of sand may find its corresponding portion of alkali, oxide, etc."

Installations of equipment for handling raw material vary as to kind of product, arrangement of plant and money available. In designing an ideal installation, let us assume our product is high grade milk bottles in

large quantities, and we are melting our glass in continuous tanks. We have an inbound siding for our raw material. With the given normal production of our glass melting tanks we erect the necessary number of storage tanks of concrete, with conical tops and flat bottoms; and coat the inside of our tanks with a moisture preventative; the size and number of these tanks to hold raw material for thirty days normal production. We will use the portable type of upright conveyor with power car unloader. The tanks will have two or more properly gated openings in the bottom. There should be a tank for cullet with the crusher mounted under the opening. They should be supported high enough to permit the free passage of combination batch car, scales and mixer, and operated either by electricity or gasoline. The thoroughly mixed batch is dumped into a floor hopper and from there conveyed over separator and thence to storage tanks over dog houses. These tanks are to hold twenty-four hours requirements and are discharged by gravity. Where pot furnaces are used, the foregoing installation could be modified by the use of hand-drawn or power-driven steel batch carts.

The modern furnaces and tanks used for melting glass, besides varying in size, differ in the application of the regenerative and recuperative principles. These processes are of sufficient importance to entitle them to a discussion beyond the scope of this paper.

Tank melting is rapidly crowding out pot melting for commercial products. Except for optical purposes, as beautiful crystal glass is made in tanks as was ever made in pots. Tanks are now in use with dividing partitions and two colors are made in the same tank.

In the operation of the regenerative type, there has recently been put on the market a combined gas and air valve that reverses automatically. It is operated by thermostatic control from the checker work.

Shaping and forming of glass articles was accomplished in a very crude way in the early years of the last century. The blower's pipe and the pontil were the principle tools used. These were supplemented by small tools made of wood and metal and later with molds made from apple or maple chunks.

Up to 1899 glass was taken from pots or tanks by blower's pipes, pontils or ladles. Since then many methods have been developed and patented. The success of the suction process was possibly the incentive that brought out the others. There are five important essentials for the success of any automatic gathering or feeding device.

1. The amount of glass supplied must be adjustable within a reasonable range.

2. The gather or gobs of glass must be uniform in size.

3. The glass must reach the mechanical device at a temperature suitable for forming.

4. The feeding must be adjustable and at such a speed as to synchronize with the operation of the device.

5. If the better quality of product is manufactured, the marks made by the cutting off or forming of the gob must be eradicated.

There are several feeders on the market that meet these requirements, and many others in the process of development. The success of the feeders has made it possible to make many machines entirely automatic. Some of these feeders employ refractory material for paddles or plungers that operate in troughs or cylinders of the same substance. The sucking or vacuum method uses an iron mold for the gob receptacle. By the use of a bait, other processes draw the glass in the form of cylinders, sheets, rods or tubes over rolls or through dies. One recently patented process allows the glass to flow out of the front of a tank, dropping between rolls that form it into window glass of any desired thickness.

Iron molds were introduced as an improvement of the old hardwood blocks. Molds made of cast iron are of three classes: iron, blow molds, paste molds and press molds. Iron blow molds are used if the design or figure on the exterior of the glass article does not permit of its rotation around a vertical axis in the process of blowing. Most of the molds of this class are made in two or more parts. The joints of the sections are reproduced on the glass and care is taken in the designing of the decorations, and the making of the mold to hide these joints or marks as far as possible.

Paste molds are so called from the coating of charcoal and adhesive substance used in covering the interior, or working surface, of the mold. Only such shapes are made in these molds as will permit of rotation. They can be made in two or more sections without the reproduction of joint seams, as the rotating of the glass in the mold removes them. Paste molds were developed from the old maple or apple blocks, and like them cooled by dipping in, or spraying with water. Up to the time of our present machines, bottles (without lettering), lamp chimneys, electric light bulbs, balls for light shades, and blown tableware were the more important articles made in these molds. The development of the paste used has made it possible to make a product as free from tool marks as the best mechanics were able to make by the "off-hand" method.

The manufacture of pressed glass required a new class of molds. The forcing of a plunger into a gob of hot glass replaced the stream of air from a blower's pipe. Molds of this class consist of two essential parts, the mold proper, or die, and the plunger. Other parts such as bottom plates and rings are often used to facilitate the operation of the mold. Hollow articles made in this class of molds must always be of such a shape as will permit of the removal or release of the plunger. Because of this the ingenuity and skill of the designer and mechanic has often been taxed in the manufacture of certain articles.

The metal used in the manufacture of molds and other devices for forming glass is a very important factor in their successful operation. Molds were originally made of just cast iron. The analysis of the iron that entered the casting was of little concern to either the foundryman or the glass manufacturer. Progress demanded a better product and much time and expense have been used to develop castings that would meet the requirements of molds. Steel, nickel, chrome, vanadium, victor metal and monel have been used as alloys with standard pig iron, with varying success. To date, the best all around castings for molds are made of pig iron and returns of the proper analysis. While the working conditions severely tax any metal used for molds, there is a great opportunity for development. An ideal mold iron must produce the article as free from marking as that produced by the "off-hand" process, and as rapidly as the machine will charge and remove the glass from it.

Just at this point it might be well to mention a machine recently put on the market for performing most of the labor in making molds. In many instances this machine will reduce costs.

Without doubt the development of the various bottle-making machines has given glass manufacture its greatest impetus during the past thirty years. Up to 1890 there were practically no power-driven machines in use for shaping glass. The first partially automatic machines were designed and used for making thin blown tumblers, chimneys and similar articles.

Prior to this, the only machine used was the hand lever press. While the press has been greatly improved as to details, the process is the same. Today we have fully automatic machines for making lamp chimneys, lantern globes, gas and electric light shades, tumblers, electric light bulbs, cane glass, tubing, window glass and various forms of pressed shapes. A single man, with these machines and their automatic feeders, carrying-in devices and lehrs, is producing what it formerly required from six to forty workers to do. The time allotted for this paper does not permit further details as to their individual operation.

In the early days glass was reheated for forming and fire polished in the openings of the furnace or tank. Glory-holes or large ovens were then introduced and various devices are now on the market for accomplishing similar or better results. There are portable glory-holes, automatic fire polishing machines and automatic finishing machines. A machine has recently been developed that shapes and rolls a thinner edge on a blown tumbler than can be uniformly accomplished by the "off-hand" process.

Carrying-in devices or conveyors are of two principle types, conveying on endless chain flights or pushing by endless chain on a smooth surface. The common method of placing the product in the lehrs is to push the articles off the carrying-in device on to the lehr pans. These devices have

replaced many boys in the glass factory and are made a part of the blowing or pressing machine, the operator of which looks after the entire unit.

The tempering of glass is a very large subject and I will only touch on the high places. The first systematic tempering was done in ovens. These ovens were heated and after the glass was placed on shelves or in pans, the doors were sealed and the temperature gradually reduced through a predetermined period of from twenty-four to seventy-two hours. The doors were opened and the glass removed. This was a sure but slow process. The old-fashioned pan lehr from fifty to seventy feet long and five feet wide was its successor.

Automatic machines brought out the continuous type which, with its modifications as to operation and construction, is at present the last word for the average manufacturer. There is still some difference of opinion as to the construction of pans and the kind of chain to use.

The use of raw gas for fuel has necessitated in most factories, a change from the open fire lehr to the muffle type. Lehr manufacturers vary considerably in their ideas as to the construction of this type of lehr. One design may prove successful in one plant and, if slightly modified to meet another glass manufacturer's conditions, proves a disastrous failure. Length over-all, width, height, size of flues and fire boxes, heat control and method of firing are far from being standardized.

The tempering of his products is a mighty serious problem to the average glass manufacturer. From natural gas at ten cents and less to thirty cents and over for raw gas is a big jump.

Mr. Collins'[1] paper last year demonstrated from tests made that a heat 25 degrees less than the annealing temperature required a lehring three times as long. An ideal lehr should have perfect heat control.

The use of pyrometers and polariscope, or commercial strain detectors, are of great value in the successful operation of any type of lehr.

An initial heat lehr has been developed and has successfully operated for the tempering of tumblers. This lehr is built close to the machine and the glass enters it immediately after the last operation. The lehr is only about four feet wide and twenty-five feet along. Fuel consumption is low as pyrometer readings run 800° F and under.

Considerable improvement has been made in the grinding and decorating of glass ware. From the grinding of tumblers to the polishing of plate glass, new equipment has been introduced.

Grinding mills have been developed that are semi-automatic. Edge grinders, for tumblers and similar hollow ware, that are semi-automatic and real producers, are on the market. Air brushes for color decorating, needle etchers and acid etching machines, are helping the glass manufacturer to keep down his labor costs.

[1] Collins, *Jour. Amer. Ceram. Soc.*, **4**, 335 (1921).

In the large factories you will find conveyors for the distribution of the finished product. Electric and gasoline small trucks, as well as over head monorail systems are performing a good work.

As one manufacturer, whose plant was fitted with automatic equipment, remarked, "Our raw material and fuel enters the north end and our finished product goes out of the south end. If we had a catsup factory on our south side, the bottles could be filled as they went out of the door; and no hand has touched them except for inspection.

Yet with all these improvements, in 1914 glass-making ranked 13th in percentage of labor cost with respect to the value of the product. Government reports for the year 1917 show labor to be 40.6 per cent in the manufacture of glass.

We have just entered upon a period of automatic glass manufacture, and there is a wonderful opportunity for the progressive equipment builder. He will, with the coöperation and assistance of the glass factory man, attain results beyond our present conception.

Simpson Foundry & Engineering Co.
Newark, O.

KILN MANIPULATION IN RELATION TO SCHOOL AND STUDIO POTTERY[1]

By Frederick H. Rhead

ABSTRACT

A suggestion for a chart to be used in connection with the firing of studio and school kilns.

The use of the chart makes it possible to record the time element, amount of fuel, and the temperature curve.

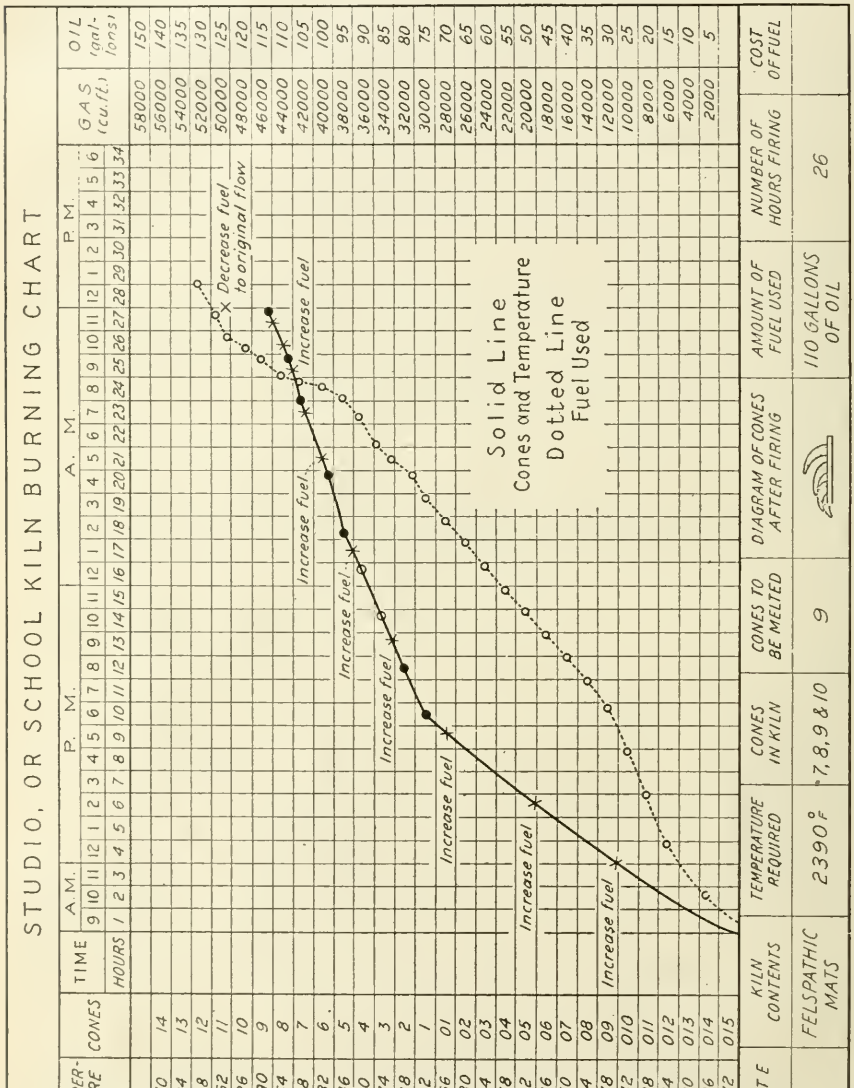
Introduction.—This discussion is concerned chiefly with methods for recording temperatures, the fuel consumption and time element in connection with the burning of studio or school kilns.

There are many studios and schools using pottery kilns where the available funds or appropriations will not permit the installation of mechanical recording equipment, consequently there should be some inexpensive yet practical method of recording every kiln firing. Very few schools or studios use charts to record the various kiln burns, and as a result it is very difficult to standardize the firing process.

Various Types of Recording Instruments.—There are a number of recording instruments. Among these may be mentioned the pyrometers of the Le Chatelier type directly registering and recording the temperatures by means of platinum or base metal thermocouples; the Leeds and Northrup optical pyrometer registering the temperature by comparing the color of the heat of the kiln with the color of the filament of a specially

[1] Art Division, St. Louis Meeting, Feb. 28, 1922.

calibrated electric light bulb; or the prismatic Wedge optical pyrometer. But only the larger schools and studios can afford even the minimum cost of a hundred dollars necessary to purchase and install any of these types.



For the average work with the smaller kilns, the Seger cones are most satisfactory, but it seems obvious that if the kiln firing operations are charted, better control and more uniform results will be obtained.

The Use of the Chart.—The studio worker and the school instructor may acquire the utmost confidence when executing most of the pottery processes, but it always seemed to the writer that most of them balk at the kiln. While kiln firing is an uncertain operation at best, it is the one process that does need the confidence and all the knowledge at the disposal of the operator. The mere lighting of the kiln, the passage of time with the periodic increase of fuel for a particular burn is not enough to insure regular and uniformly repeated results. If each firing can be approximately charted, the operator will possess information which will be found most valuable for future work, and in addition the firing operation can be regulated to a much greater extent than is commonly possible.

The chart outlined gives a fair idea of this method of recording the firing process. It shows the time element, actual time of lighting and finishing the kiln, amount of fuel consumed with the periods of increase, and in the lower part of the chart a diagram of the cones after the kiln is finished.

If air is used, either in connection with oil or gas, a column recording the volume or pressure can be added at the fuel end of the chart. Under such conditions the operation of the kiln, when reducing atmospheres are required, can easily be regulated.

It is a simple matter to rule up a chart for each firing, or blue prints could be made. If I were a manufacturer of portable kilns, I would supply these charts with the kiln.

This system would also be valuable in factories possessing no pyrometer equipment. The number of large plants possessing no filed records of their kiln operations is surprising. No matter how skilful or reliable the kiln fireman may be, it would seem to be good business to have some system where the past and present practice of this most important process may be subject to investigation, supervision and regulation during the burning period.

COLLOQUIUM ON FELDSPAR AND FELDSPAR GRINDING[1]

Note by Editor:—In the discussions to date there has been less on quality and specifications than is desired. Eventually there will be a consideration of relative merits of the so-called hard and soft or the more easily fusible and refractory feldspars for general ware, porcelain insulators, floor tile, glazes, etc. Such questions have already received the attention of ceramists, potters and tile manufacturers, whose definite and quite different individual preferences are based on extensive manufacturing experiences. Facts and experiences concerning all of this will be brought out before this colloquium is concluded and before a definite schedule of research is determined. For the present, attention is directed

[1] Continued from *Bull. Amer. Ceram. Soc.*, **1**, 78 (1922).

to methods of milling and effect of each process on cost and quality. A poor grade of feldspar for many requirements is expensive at any price while for several purposes a lower quality of feldspar is as good. The cost, however, should be accordingly lower.

There seems to be a market for each sort of feldspar produced but neither the user nor the producer, generally speaking, seem to have definite knowledge of the requirements for every sort of ceramic ware. It would seem that definite specifications, together with permissible range in variation, would be desired by both parties and it is to this desideratum that this informal colloquium is being directed, taking one step at a time. For the while, attention seems to be directed more on economical methods of milling; but in this there must be a consideration of the quality of feldspar produced, the effect of the grinding process on quality as well as on cost.

Is there a preference for water-ground feldspar and why? Can 160-mesh feldspar be produced as economically and of as good a quality by the dry as by the wet?

What are the considerations, in general, for using wet or dry, conical mills, tube mills or batch mills?

What dimensions of mills are most suitable for given purposes and why?

In a continuous or closed circuit, with wet or dry grinding, how much of the discharged material is returned to the mill for regrinding and how can this be regulated?

What is the most economical equipment as to quality and cost per ton (or ton per hour), for intermediate grinding and why? Give the facts and figures.

To what extent does character of feldspar rock affect such considerations as the foregoing, what are these characteristics and in what manner and degree are they effective?

What are the significant factors causing the variation in production in the following citation from a letter from Joseph P. Rodgers?

"A very considerable difference in the fineness of feldspars is due to the character of rock ground. Our Hardinge mill (grinding wet) will produce forty-five hundred pounds per hour when we are working on the product of a certain quarry but it will not produce in excess of thirty-five hundred pounds per hour when grinding the product of another quarry. When an average quality of rock is being crushed, our production is two tons per hour. Tests of this material made yesterday (May 25, 1922) disclosed the fact that 61.5% of it will pass 180-mesh brass cloth, using the wet test, 66% will pass 120-mesh cloth and 95.5% will pass 40-mesh. All of the material taken from the mill passes through an 18-mesh screen.

By N. W. Stern (San Francisco):[1]—In the first place, I want you to

[1] May 24, 1922.

realize that I am in a different position from the millers in this country. We are potters and own our own feldspar deposit and do our own grinding. We have an enormous deposit and use great care in the grinding of our materials.

Mr. Kiliani of the Hardinge Co. came to this coast and interested me in a Hardinge mill. He guaranteed a certain capacity and certain fineness. On the strength of his guarantee, I ordered the mill. I followed his instructions implicitly, making all the changes he suggested at various times. All of these resulted in naught. The mill now reclines on the junk pile.

Our present flow sheet is a very simple one. We put the rock on a crusher of the old chaser type with six-foot stone and with twenty-inch space. From here it is conveyed to the Emeric separator. The fines are removed and the coarse goes into a 5 × 22 tube mill lines with Silex. The discharge of this mill goes on to the same conveyor that comes from the chaser. In this way we avoid iron and have but the one hauling, that is, putting it on to the chaser. Before we erected this plant we had a chaser, a screen and a 6 × 10 Patterson type batch mill, which gave us nine to ten tons of material a day, which, up to that time, was sufficient to keep us operating. This worked admirably but the cost of operation was a little higher than on our present scheme.

Mr. Ladoo has, in my opinion, made a serious mistake in recommending the Hardinge mill for dry grinding. This mill is used in ore dressing and is, as I understand it, a great success when grinding wet, but for dry grinding it is an absolute failure and I should think Mr. Ladoo would go into this matter more thoroughly with the people who have attempted to use this mill for dry grinding, before recommending it for this method.

Since we are grinding feldspar only for our own use, our grinding practice differs somewhat from that which it otherwise would be. We have had no trouble with mica as all our feldspar is used in the pottery where the mica is removed on the lawn. As a matter of fact most of the mica comes out in fairly large pieces at a separator as it comes from the chaser, thus it is not ground to a fine powder. Such as is reduced to fine powder is for the large part removed when the body mix is lawned in the pottery.

We have absolutely no iron in our feldspar as the only thing that touches our material is the chaser stone and the Silex lining of the tube mill.

I agree with Mr. Ladoo in that the millers have been grinding a very inferior grade of feldspar due to the fact that the accessible quarries have previously been picked of all good feldspar and today the feldspar that the potters receive is a very undependable grade. That is the main reason that we have purchased our own deposit and are doing our own grinding.

A few dollars a ton on feldspar is very insignificant compared to the quality of merchandise in which it is to be used.

The potters have often said that the beginning of winter is the best time to lay in a stock of feldspar as the mills are all piled with feldspar during the summer and they select the best feldspar first, leaving the inferior grade to grind later in the winter, so that just before the quarries open you get nothing but the cull.

By R. B. Ladoo:[1]—In my discussions previously submitted, I have expressly stated and repeated in several places that the flow sheet suggested was a composite of various machines and methods in actual use in feldspar mills today.

Even if no mills of this type were now used by feldspar companies their success, under almost identical conditions in other industries, would justify a trial by feldspar companies. Innovations always require a period of experiment, trial and adjustment, and my flow sheet was offered as a basis for experiment derived from the successful experiences of other companies.

I am aware that Hardinge mills have been tried unsuccessfully in the past by several feldspar companies. As I have already pointed out in a previous communication, the Hardinge mill was designed for the wet grinding of metallic ores and until recent years the problem of dry grinding of non-metallic minerals was given little attention. Mills designed for wet grinding were tried unsuccessfully for dry grinding. More recently, the company's attention has been given to the problems of dry grinding and changes have been made in the Hardinge mill. For example, in some instances where a six-foot Hardinge mill would be used in wet grinding, an eight- or ten-foot mill is now recommended. Furthermore, as I have previously pointed out, some feldspars, particularly those high in quartz, may not be as well adapted to this type of mill.

It should be noted that the success or failure of any method of continuous dry grinding of feldspar is dependent upon the development and use of a suitable method of sizing the milled product and returning the oversize for regrinding. This is true whether the mill used is the Hardinge, the Marcy, the Allis-Chalmers, or any other type of either short or long continuous pebble mills.

At present the best method of fine sizing seems to be by the use of some form of air separation, of which there are a number of types. Air separation has been used for many years. The problem of fine sizing is not peculiar to the feldspar industry, but the identical problem is found in the grinding and sizing of many other non-metallic mineral products. The loss of fine materials by floating off in the air to which you have referred

[1] May 24, 1922.

can be reduced to a minimum by the use of tight housings, as has been done in similar installations in other industries.

In my flow sheet I made no provision for hand-sorting prior to intermediate grinding, as I had previously outlined in my paper a method of crushing and hand sorting to be used either at the mine or at the mill. The place to do hand-sorting is preferably at the mine, so as not to incur the expense of hauling waste material to the mill.

I would again call your attention to the fact that I have proposed no system which is radically different from any now in use, but I have merely suggested as a basis for experiment a composite flow sheet made up from parts of mills found most successful in actual practice.

By V. A. Stout (Hardinge Company):[1]—I have been extremely interested in Mr. Ladoo's article on "Conditions in the Feldspar Industries" and the discussions it has called forth. My interest comes naturally from a close association and study of the industry, as the representative of a company selling a continuous grinding machine which has been more or less successfully introduced into that industry and which Mr. Ladoo was kind enough to mention favorably. However, it is not from the viewpoint of a representative of the company selling that mill that I wish to enter this discussion, but rather as an engineer, who has made a careful study of its grinding problems.

There are too many questions involved to warrant my doing anything more than touch them briefly. I shall, however, give some little space, if I may be permitted, to the so-called closed circuit system of grinding, the character of the product produced, and the economies of its operation. I feel that Mr. Ladoo's criticisms of mining methods have been rather well covered by previous discussions.

Mr. Rodgers in his discussion on the milling end suggested one difficulty about this so-called new process, which I think needs answering before I get into the main body of my discussion. He stated that some potters refused to buy feldspar which has been crushed in a crusher, of course, because of the iron contamination. Two methods are possible to meet this difficulty. One is by means of a magnetic pulley following the jaw crusher to take out the iron introduced into the feldspar when crushing it. This is, perhaps, the surest way but it is somewhat complicated and might be objected to as being an added expense. The second way is not so sure, but it has proven successful in actual operation. This is the use of the highest quality manganese steel for the jaws of the crusher. One company using the system described in Mr. Ladoo's article with manganese steel jaws on the crusher have been able to sell their feldspar on the potter's own test at a top price in the market.

[1] May 26, 1922.

And now as to the quality of the feldspar produced by this system. Quality must be judged from the viewpoint of marketability and that means the potter's specifications. These cover freedom from iron contamination and fineness. In the system described there is an absolute and positive control of the fineness. Either the Hummer Screens or the Emerick Air Separator are easy of adjustment and positive of their control of fineness. These machines are working today in connection with Hardinge Mills to produce feldspar which is being sold to the ceramic trade. There is no oversize on 140-mesh in the product of these machines and who among the grinders of feldspar can say that he never has had trouble with oversize in his product even after it had been ground the customary length of time in batch tube mills.

We have already discussed the question of iron contamination from the crusher. There can be no iron contamination from the Hardinge Mills which are lined with Silex, and use Danish flint pebbles as grinding mediums. Careful and exhaustive tests show that neither the Hummer screen nor the Emerick Air Separator will contaminate the finished product with iron. Since the results of these tests have been checked by the actual operation of commercial plants selling ground feldspar to the ceramic trade, we can rest assured that no iron contamination can harm the marketability of the product.

Having assured ourselves that the product of this closed circuit system of grinding is right and that it is marketable, let us examine the economies of operation of this system when compared to the practice of intermittent or batch grinding preceded by chaser mills for the preliminary breakdown. Without betraying a trust by mentioning any names, we can give below an actual comparison of costs between the two systems.

The following figures give in detail the costs of the continuous system of closed circuit grinding in Hardinge mills with control of the finished product by means of air separation just as outlined in Mr. Ladoo's article based on a capacity of 3 tons per hour of feldspar ground through 140-mesh, 98½% through 200-mesh.

POWER

	H.P.
1—No. 4 Jaw Crusher (preliminary break)	20
1—Elevator	3
1—10″ x 16″ Crusher (finished crush—through ¾″ ring)	15
1—16″ Belt Conveyor (crushed feldspar to bins)	2
1—Elevator (first Hardinge mill to screens)	1
1—8′ x 36″ Hardinge Conical Pebble Mill	50
1—8′ Hummer Separator (preliminary grind through 30-mesh)	2
1—12″ Belt Conveyor (to secondary bin ahead of finishing mill)	1
1—8′ x 48″ Hardinge Conical Pebble Mill	75
1—12″ Belt Conveyor (finished bins to cars)	1

1—Elevator (to air separator)	1
1—14′ Emerick Air Separator (to control finished product)	20
Transmission Loss	2
	193

193 H.P. hours at $1\frac{1}{2}$ c per H.P. hours divided by 3 tons per hour 9.65c

Repairs

1. Hardinge Mills—		
(*a*) Pebble Wear 3 lbs. per ton @ $1\frac{1}{2}$c	4.5c	
(*b*) Lining Wear $\frac{1}{2}$ lb. per ton @ $2\frac{1}{2}$c	1.25c	
(*c*) Wear on Mill Parts (feeders, gears)	2.0c	
2. Hummer Separators—Screen		
Life 30-mesh separation 6 mos	0.6c	
Other Repairs	0.5c	
3. Elevator and Conveyor Repairs	10.0c	
4. Shafting, bearings, bolting, etc	3.0c	
5. Emerick Air Separator	10.0c	
6. Jaw Crushers	2.0c	
7. General Plant Maintenance	1.0c	34.85c

Oil and Grease

Motors or Engines	4.0c	
Crushing and Grinding Machinery	4.0c	8.0c

Labor

5 men — 50c per hour	83.0c	
1 Engineer or Electrician — 75c per hour	25.0c	108.0c
Total Cost per Ton of Ground Feldspar	$1.6050	

Costs in plants of the intermittent type will vary with their locality which affects the items of labor and power, but we think that the figures given below may be taken as fairly representative and at least they have the power and labor costs figured on the same basis as that used above. This plant using chaser and batch tube mills with a total capacity of 60 tons finished in 24 hours had costs as follows:

Power @ $1\frac{1}{2}$c per H.P. hour	20c
Labor	120c
Repairs	160c
Oil and Grease	10c
Total Cost per Ton of Ground Feldspar	$3.10

I hear at once the cry go up from the feldspar grinders: "My costs are not that high." I am, of course, not in position to judge individual costs in individual plants scattered over the country. Perhaps it would be unfair to label the above costs of the intermittent system as "representative." However, the costs of the continuous system are given in

detail so that all may study them and compare them with their costs of grinding feldspar. The difference between the two sets of figures is so marked that even a 20% variation downward for the intermittent system of grinding would still show a big saving in favor of the continuous system. There seems little question that a feldspar meeting the specifications of fineness and freedom from iron contamination can be produced by the continuous system of grinding in Hardinge mills in closed circuit with screens and air separators at a most reasonable cost which is probably very much lower than costs of the older systems of chaser mills and batch tube mills.

By Everett Townsend:[1]—Our plant is a very small one and we have only been running it since January 1. Our pebble mills are six feet eight inches in diameter and make twenty-seven revolutions per minute. The feldspar from the chasers is put through $^1/_4$″ mesh wire. The mill is run $6^1/_2$ hours. We put 3500 lbs. of feldspar to a charge and use 4700 lbs. of pebbles of a uniform size. This grinding gives us feldspar fine enough to go through 120-mesh wire lawn, with less than 1% residue. In testing this through the lawn, we mix it with water and run it through the lawn in the slop state.

Our six months observation and experience in grinding "Rock Spar," a pink (not the white variety) orthoclase feldspar, is as follows:

We have tried to contract for what we term the "Crystal Spar," which in its pure state is practically free from free silica; our classification being that we cannot see any quartz with the naked eye. Some miners say that it is permissible to have from 5% to 10% of free silica in the feldspar and still call it selected quality. The trouble is, when you contract for selected feldspar, there creeps in a lot of rock that runs too high in quartz.

An empirical test, using a sample from a grinding of the purest crystal rock, and a sample from a grinding of rock from the same mine having a content as high as 10% of quartz showed equal fusibility. Hence, for tile the writer could not observe any different results between the bodies made from the pure "Crystal Spar" and the feldspar with the 10% of free silica.

With more than 10% of quartz content, say 25% or 30%, there are a great many impurities appearing in the rock, such as tourmaline and sulphide of copper. We have not observed a great deal of tourmaline but there is in some of the mines a great deal of sulphide of copper, which is impossible to cob out. Before putting in our own mill, we had a very costly experience with ground feldspar from a rock containing a large quantity of this impurity.

[1] May 30, 1922.

We have noticed that as the vein gets poorer it runs up against "Granite" walls. We have received some quantities of this in our shipments. As I understand it, this "Granite" rock is feldspar, quartz and mica. We have had a small lot of this class of rock come in some of our carloads but, of course, have thrown it out. We have not made a special grinding of this "Granite" rock so that we do not know how it would test by itself. We are breaking all our rock feldspar up by hand before putting it under the crusher, so that we can cob out and throw away any rock that is not up to the standard we desire.

We can get the pure crystal rock, with practically no quartz showing in the rock, providing we pay the price for it. This is the class of feldspar we are now using. But the miners should get a good price for this class of feldspar, and the grinders also. There, of course, must be a market for the No. 2 grade, free from metallic impurities, or otherwise the miners would have to get a much higher price for their selected feldspar. Therefore, if the buyers want the best, they must pay the price. If they buy at a low price, they will certainly get a No. 2 grade of feldspar.

By V. A. Stout:[1]—There has been sent around to the various people interested in the discussion of Mr. Ladoo's paper on "The Grinding and Milling of Feldspar," a colloquium in which there are certain questions asked and which it would be desirable to answer, particularly on the part of the miller, and since the writer is in better position perhaps to do this than are others in the profession, he is again entering the discussion to clear up certain of these points.

The first question asked was as to the preference of water-ground feldspar, and why. This part of the colloquium I would leave to the potters, since they can answer this question better than I can. The balance of the question, however, "Can 160-mesh feldspar be produced as economically and of as good a quality by the dry as by the wet process," the answer is that it undoubtedly can. However, the main difficulty with the wet process is the drying of the material after it has been ground to pass through 160-mesh. It is a whole lot easier to drive off the surface moisture from feldspar when it is in the lump state, say one or two inches, than when it is pulverized to pass through 160-mesh. This very fine material requires an elaborate equipment for settling out the water and bringing it down to a moisture content where it can be finally dried in specially designed dryers to eliminate any iron contamination. All of which is extremely expensive and a very difficult process.

The second question is "What are the considerations, in general, for using wet or dry conical mills, tube mills or batch mills?" The main consideration should, of course, be the quality of the finished product,

[1] Received May 26, 1922.

and the cost of producing this product. That system which gives the best quality of finished feldspar, that is, with the greatest marketability, the most economically, is undoubtedly the system which would meet the universal test of desirability of milling equipment for the entire industry. Into the cost of grinding must, of course, enter the drying of material and the power consumption, which is the major expense of milling. Of secondary importance also is the labor and attendance.

The next question is "What dimensions of mills are most suitable for given purposes, and why?" This question is certainly answered by the direct statement that in other industries the batch mill, tube mill, and conical mill have all been tried out competitively, and it is the results of these tests that must control the choice of the miller who is figuring on the installation of a grinding plant.

The next question is "In a continuous or closed circuit, with wet or dry grinding, how much of the discharged material is returned to the mill for regrinding and how can this be regulated?" The answer to this question is that the more material that is returned to the mill, the more efficient will be the grinding, and it is attempted in certain industries today to crowd up this material coming back as a reject to three or four times the initial feed going to the mill. This, of course, calls for a short length of mill through which the material can be rushed with only a relatively small amount of grinding done in each passage, but ultimately by building up the process a very large capacity with a low power consumption. This is the secret of closed circuit grinding and it has been developed to its highest fame in the mining industry in wet grinding mills, where circulating load or return of oversize from the screens or classifiers amounted in one instance to thirteen times the initial feed, and in a great number of instances to five or six times the initial feed. Normally, we would say that if as much oversize is returned to the mill for regrinding as is fed to the mill, then the efficiency of the system will be fairly well established.

The next question is "What is the most economical equipment, both as to quality and cost per ton (or ton per hour), for intermediate grinding, and why? Give the facts and figures." We take this question to refer to intermediate grinding of material through 90-mesh, which is known as the No. 2 product. As a manufacturer of equipment, we do not feel it consistent with our attitude in this discussion to describe what we consider the most economical equipment for this particular type of grinding. However, we can say that the closed circuit arrangement of a large diameter, short length pebble mill, with screens, has proven very satisfactory in a great number of instances and undoubtedly shows a much lower cost per ton for the finished material, as against batch grinding, even with the relatively shorter length of grinding necessary to produce this intermediate product. Our records show that $2^1/_2$ tons per hour of feldspar

can be finished in a Hardinge mill, operating with screening equipment, to 90% through 100-mesh, for a power consumption of 50 h.p. or 20 h.p. hours per ton, one man being in attendance, and the cost for pebbles, lining and general maintenance of the entire plant not exceeding 25 cents per ton.

The next question is "To what extent does character of feldspar rock affect such considerations as the foregoing and what are these characteristics, and in what manner and degree are they effective?" Insofar as the grinding is concerned and its costs, we have not found that any variation in character of the feldspar has any material effect upon the cost of grinding.

In answer to the final question of the colloquium, which gives a quotation from a letter by Mr. Jos. P. Rodgers, in showing the variations in capacity of a Hardinge mill, wet grinding, from 4500 lbs. on a certain feldspar produced from a certain quarry, and 3500 lbs. from another quarry, there is only one answer and that is that the one feldspar is harder to grind than the other. There is, of course, bound to be a certain variation from day to day in the relative hardness of feldspar and this hardness means that more energy must be consumed in grinding it, since in a given mill you only have a given output of energy; then naturally, the capacity of that machine will vary slightly. There are unquestionably different hardnesses of feldspar which must be taken account of in grinding, but all of which can be readily solved by simple and inexpensive tests, which, in the case of the machinery manufacturer with proper knowledge, can be very carefully predicated in advance.

N. W. Stern brought up certain points, which I think must be answered. The mill to which Mr. Stern refers is a 6-ft. diameter by 48-in. length of cylinder Hardinge Patent Conical Pebble Mill, sold him in 1916. At that time we did not know as much about grinding feldspar as we know today, but even then we knew enough to recommend that this mill should be operated in conjunction with suitable separating device to control the fineness of the finished product, and that the reject from the separator should be returned to the feed end of the Hardinge mill for further grinding. This recommendation was made to Mr. Stern.

Mr. Stern stated that at the start he did not care to install these separators, but would try the mill out without them, leaving their installation until a later date. These separators were never, to my knowledge, installed and their not being installed is the fundamental reason, as far as we can determine, for the failure of this Hardinge mill, which produced in the discharge from the mill 30% to 40% coarser than the 160-mesh required by Mr. Stern. If, however, the separators had been installed, this 30% to 40% oversize would have been taken out and sent back to the mill for further regrinding, the separator being adjusted so that the

product would all have been of the desired fineness and the installation made a success.

The capacities of conical mills, in grinding feldspar, are all based upon closed circuit grinding where a fairly uniform and fine product is desired, for experience has shown that operation in this manner produces the desired results at much less cost than if operated any other way.

DISCUSSION BY HARLOWE HARDINGE:[1]—Speaking from a manufacturer's view-point, there are a number of conditions which must be met which the mill man would not foresee. Some of these conditions I will outline in this communication. First of all, there are certain business ethics involved in giving out information which has been given to us in confidence, and it is these business ethics which have caused us to withhold concrete information which we have in our files because we have agreed not to publish or send out broadcast certain very conclusive information which we have received. There is little good in giving concrete facts if you cannot show where and how these facts were obtained. In short, our hands are tied.

Many times we have tried to get certain facts released so that we could prove to some of our business acquaintances the statements which we make involving the operation of our equipment, but in almost every case we met with an emphatic refusal.

We ran up against the very unsatisfactory condition of second-hand machinery dealers getting hold of Hardinge mills, which come on the market from time to time, and selling them to companies without regard to the work they are to perform. The main burden then devolves upon the purchaser to make the mill suit his conditions and unless he knows something about operating a mill of this type, he may get into trouble (or it may be a ball mill instead of a pebble mill). Hence, every once in a while we run up against a so-called unsatisfactory mill, and upon investigation find that it is supposed to do work which we would never have recommended had we an opportunity to advise.

Often we come against the difficulty of a slightly different size of mill; for instance, we build an 8-ft. diameter by 22-in. cylinder, 8-ft. diameter by 30-in. cylinder, and 8-ft. diameter by 36-in. cylinder. There is very little difference in the lengths of these cylinders. Hence, a second-hand dealer would say that he has an 8-ft. diameter by 22-in. cylinder mill. The Hardinge Company may have recommended an 8-ft. by 30-in. mill, and there being only 8-in. difference in the cylindrical length, his mill will do just as well. As a matter of fact, an 8-in. difference in the cylindrical length sometimes means as much as 30% difference in capacity. The purchaser does not condemn the second-hand dealer but he does the Hardinge mill.

[1] June 3, 1922.

Another point—in fields like the ceramic industry, which have a tendency to great secrecy, some companies, in order to retain their secrets or steer their competitors away from methods they employ, send out derogatory reports of the equipment they use, not that they are doing anything unethical, but they will make a point that whenever their equipment is not running right up to the minute, they will take pains that the outsider hears about it but he does not hear about the other 360 days of successful operation which enables him to keep his costs below his competitor.

These conditions which we run up against are in my opinion the chief cause for the delay of the general acceptance of our mill in the ceramic industry, for we know what the mill has done, having been on the ground ourselves and having seen the mill operating under average conditions. We have checked up the costs and found them to be so much lower than the average that it is difficult for us to comprehend, until we reflect upon the conditions as mentioned above, why this system has not been generally adopted long before this.

By Harlowe Hardinge:[1]—Every plant, with which I am personally acquainted, where we are grinding feldspar, is operating dry, with the exception of a 5-ft. mill installation at the Dental Supply Co., York, Pa., where a very high grade of feldspar goes into the manufacture of false teeth and where the fineness must be regulated very carefully. Such installations as at Erwin Feldspar Co., the old installation at Clinchfield Products Co., Bedford Feldspar Co., Mount Eagle Feldspar Co., the new installation at Golding-Keene Co., and a number of other installations, are all grinding dry.

The references of where the Hardinge mill has "failed" are all on account of old methods of operation which took place a number of years ago, when we did not know as much as we do now.

Mr. Rodgers says that Mr. Ladoo exaggerated the capacity of the mill and that the most he could ever put through an 8-ft. diameter by 22-in. cylinder Hardinge mill was 4,500 pounds per hour and that the 30-in. mill has an advertised capacity of 10% greater than the 22-in. mill. Mr. Rodgers' statement in reference to the old style mill is absolutely right but he fails to take into account that the design of the Hardinge mill has been greatly improved and we have also learned more about its operation. By changing the type of feeder, and also the inlet and discharge of the Hardinge mill, we have found the capacity to be very materially increased and as we operate these mills in an entirely different way than heretofore, Mr. Ladoo's estimates are not exaggerated.

As a concrete example of what has been done within the last two years

[1] June 9, 1922.

in grinding, I will cite our installation at the plant of the Lytle Coal Co., Minersville, Pa., which is dry grinding a very hard anthracite coal. Although coal is not the same as feldspar, the general operation is very similar. The Lytle Coal Co. were casting about for a machine to grind anthracite coal to a fineness of about 90% through 200-mesh. The mills tried out previously had proved too expensive from a standpoint of upkeep. From previous operation on similar materials, even taking into account our old operation of grinding feldspar, we recommended one of our mills to do one ton per hour to a fineness of 90% through 200-mesh. Changes in the method of operation were made which increased the capacity of this mill to $2^1/_2$ tons per hour. Another design of mill, having the same diameter as the first but changed in other respects, maintained a capacity of 3.67 tons per hour average over a month's operation. Often the capacity ran well over 4 tons per hour, the product being better than 92% through 200-mesh, the mill operating in conjunction with an air separator. This is four times as much as originally estimated and as a result this company recently ordered two 7-ft. diameter by 36-in. cylinder Hardinge Ball Mills to complete their installation.

The Canada Cement Co. is grinding a cement clinker, known to be the hardest clinker in the country. They installed our large 10-ft. mill to grind approximately 17 tons per hour, but are actually averaging over 25 tons per hour.

DISCUSSION ON "DERRY FELDSPAR QUARRY"[1]

By Raymond B. Ladoo:—The feldspar deposit described by Mr. Davis seems to be unusual, both in size and in the purity of the feldspar which it contains. While it is true that, in some districts, there occurs but one large deposit of unusual merit, surrounded by other deposits smaller and less pure, this condition does not seem to prevail generally.

In several of the large feldspar producing districts of the United States a number of deposits, nearly equal in size and purity, have been worked and other deposits discovered and held in reserve which seem to give promise of equal value.

Until the market price of feldspar reaches a point which will encourage the very thorough and systematic prospecting of less accessible areas, both in the United States and Canada, the presence or absence of other large deposits of feldspar cannot be definitely proved.

By H. Ries:—I have read Mr. Davis' paper with much interest. The general region in which the Derry quarry occurs has been proven to contain some most interesting deposits of feldspar. In the famous Richardson

[1] Davis, *Jour. Amer. Ceram. Soc.*, **5**, 294 (1922).

quarry, east of Godfrey, worked for a long period, there was a differentiation similar to that described by Davis. There the quarry showed a very large mass of deep pink feldspar in the center of which was a huge horse mostly of quartz.

The Richardson feldspar emphasized a curious fact, even more forcibly than does the Derry, that the cream or bright pink of feldspar is not necessarily due to iron oxide.

THEORY OF PLASTICITY AND POSSIBLE COMMERCIAL APPLICATION

A colloquium on this topic was intended for the Annual Convention. George A. Bole delivered an opening address, the substance of which is in his paper.[1] F. P. Hall[2] presented a summary of methods for measuring plasticity. Time did not permit extending the discussion at the convention as was planned. Hence it has been continued by correspondence.

The Editor was asked to open this informal discussion which, if done editorially, would require a review of the literature and an impartial presentation of the several theories that have been advanced. This seems to be unnecessary inasmuch as references will be made as the discussion progresses. The Editor would rather enter as a free lance, without editorial restrictions, and the following discussion is written with this freedom.

Discussion by Ross C. Purdy:—My first approach to this question of plasticity in 1904 was from a reading knowledge of the several experiments and theories reported in the literature. I accepted the very plausible theories that the "clay substance" was somewhat soluble in water and that clays contained alumina, silica and iron hydrates which would reverse back and forth from the gelatinous state (as when precipitated from solution) to dry powder. The dry powder of these hydrates was a "gel" which would adsorb enough water to again render their mass gelatinous. I had the conception that the portions of clay, which were too small to be distinguishable under an ordinary microscope, were the prime factors in rendering the mass as a whole plastic and that it was these small particles which, through some process of molecular disintegration and hydration, went into solution, thus making a gelatinous-like mass similar to freshly precipitated aluminum hydroxide. The physical phenomena of Brownian movement and of flocculation and deflocculation were thought to be evidence of ionization reactions between the salts

[1] "Mechanism of Plasticity from Colloid Standpoint," *Jour. Amer. Ceram. Soc.*, **5**, 469 (1922).

[2] "Plasticity of Clays," *Ibid.*, **5**, 355 (1922).

in solution and the products of partial disintegration of the "clay substance."

At that time we understood it clearly that, when speaking of colloids, reference was made to state of matter rather than substance, *i. e.*, the distinction between crystalloidal and colloidal state was without reference to substance, it being supposed that all substances could be produced in either state. It was not clear, however, what state or condition a substance must be in to be distinguished as colloidal or how this transformation could be effected.

The picture had at that time of colloidal condition was exemplified by the physical properties of precipitated aluminum hydroxide, silicic acid and glue as the "gel" state, and these same things by some process converted to solutes as the "sol" state, the transition from the "sol" to the "gel" state being that of gradual precipitation from solution.

Dr. Paul Rohland[1] gives these same misconceptions which we had of colloids in 1903 to 1905. If needs be, during the progress of this colloquium, I will give an exposé of Rohland's treatise to show the very far-fetched and ill-grounded conceptions that were generally held at that time.

It was with these misconceptions regarding colloids in clays that I started work with the Geological Survey of Illinois in the fall of 1905 and it was because these conceptions would not plumb with proven chemical and ceramic facts that I had to search for evidence independently of the orthodox colloid chemistry of that time.

I came early to the conclusion that one of the reasons that chemists had been lead astray, regarding colloids in clays, was the terminology used, and hence, in the discussions with Mr. Ashley,[2] I was not only making constructive criticisms of the conceptions advanced by him but also of the terminology used.

One paragraph[3] of my discussions of Mr. Ashley's paper reads as follows: "To claim that the clay particles must be wrapped about by a colloidal coating, because the clay responds in like manner in one test with colloids, is of the same order in logic as claiming the existence of an element 'phlogiston' which all chemists did prior to the discovery of oxygen by Lavoisier in 1774."

Dr. J. W. Mellor,[4] in 1921, or twelve years later, writes: "Clays have qualities which might be predicted from the known properties of matter in the colloidal state. It is, therefore, assumed that clays contain x per cent of colloidal matter possessing qualities like those possessed by the clay itself." This explanation recalls A. Baume's "saline matter" and the

[1] " The Colloidal and Crystalloidal State of Matter."

[2] *Trans. Amer. Ceram. Soc.*, **11**, 530 (1909).

[3] *Ibid.*, **11**, 586 (1909).

[4] "On the Plasticity of Clays," *Trans. Ceram. Soc.*, **21**, I, 92 (1921).

"terra pingua" of the mediaeval chemists. The plasticity of clay has been attributed to both these imaginary substances. Indeed, just as in mediaeval times, every chemical process which was not understood was explained by an assumed terra pingua or phlogiston, so now we are inclined to attribute to the colloids every quality of clay which is not understood. Nevertheless, I believe a modified colloidal hypothesis gives the best working explanation of several properties of clay, even though it must be added that we have not progressed very far in advance of the eighteenth century. Calling the same things different names is not getting along very fast.

I have never denied the existence of colloidal matter in clays.[1] I have questioned, and still question, if plasticity of clays follows from any such process as described by Ashley[2] when he says "effect of the grinding is to expose fresh surfaces of these minerals upon which the water has a hydrating effect, forming colloidal hydrates."

An idea of the length to which the reasoning without facts went at that time, can be had from the following:[3] "The difference between the normal and the preheated clays is due to coagulation, the material has become set, to use the language of the colloid investigators, and irreversible, as far as practical purposes are concerned."[4] "He explained the change produced on the basis that the organic or inorganic colloids are shriveled up and rendered either temporarily or permanently unable to take up water and assume their former jelly-like condition."

"The chief colloidal materials[5] to be considered in clays are silicic acid, aluminum and ferric hydroxides, and the organic emulsion colloids."

"In the light of colloid chemistry,[6] we may consider these minerals in contact with water as tending toward a state of equilibrium. At the point of contact there is the tendency of the mineral to go into solution; but the action is slow, hence the colloid condition has a chance to develop"—— "at the same time new mineral combinations are being formed and part of the oxides produced go into the sol state and may later become gels. Where alumina and silicic acid sols are being formed at the same time, they tend to coagulate one another to gels. Other colloid sols have a similar effect on one another"——. "The finer the grain of the clay, the more chance there is for colloidal material to form"——. "The longer the clay particles are subjected to the solvent action of water, the more colloidal material is formed."

All of these quotations (and many more of the same sort could be quoted

[1] *Trans. Amer. Ceram. Soc.*, **11**, 590 (1909).
[2] *Ibid.*, **12**, 810 (1910).
[3] Bleininger, *Ibid.*, **12**, 506 (1910).
[4] Orton, *Ibid.*, **13**, 774 (1911).
[5] Davis, *Ibid.*, **16**, 76 (1914).
[6] *Ibid.*, **16**, 79 (1914).

from the *Transactions* of this Society and from the literature) are in line with the fallacies taught by Dr. Paul Rohland in 1913 and earlier, and which are yet being advanced by some physical chemists.[1]

Definition of Sol.—Bancroft[2] says "Sufficiently finely divided particles will be kept in suspension in a liquid indefinitely by the Brownian movement, provided coalescence and the resulting agglomeration are prevented. Such a colloidal solution is called a sol."

The portions of clay suspensions which will not clear after weeks of standing are an example of coarse sols comprising discrete particles which do not coalesce, plus salts adsorbed and in true solution, and water.

Definition of Gels.—Again quoting Bancroft, "When the colloidal particles agglomerate and precipitate, the precipitate is called a gel." There is no reference in the foregoing definition of "sol" to hydration, hydrolysis or anything other than suspension. In case of clays it is a suspension of discrete particles. The only portions of a clay that approach the "sol" state are the ultra fine particles, and the only "gel" then are these fine particles agglomerated. As a matter of fact one can wash out all the fine particles produced by thorough disintegration of the clay, and the coarse particles of hydrous silicate of alumina will, as a rule, exhibit the same plasticity as when the fine particles were admixed. The fine particle portion will not be plastic, cannot be dried and rewetted or likewise worked as clay. Furthermore, the coarse particles remaining will flocculate and deflocculate with electrolytes as before. In other words, neither the plasticity nor the behavior of clays with electrolytes are dependent on or are much influenced by that portion which would come under the definition of "sol" and "gel."

The terms "sol" and "gel" have application in the physical chemistry of clays only in a far-fetched sense; they are pictorial terms and not really applicable to the whole clay mass; they give misconceptions.

Rather than "sols" and "gels" I plead for the use of the common sense and truthful terms "deflocculated" and "flocculated." They leave out of consideration the solution ideas and refer only to dispersion and precipitation of discrete clay particles without any hydration, hydrolysis, coalescence or other physical chemical alterations in composition.

Clays do not form typical colloidal solutions; only a small portion of any clay roughly approximates such and really is not essential to plasticity. If "sol" and "gel" are not applicable to the discrete particles which will not stay in suspension but will nevertheless flocculate and deflocculate, why use such foreign language?

[1] Moore, Fry and Middleton, *Jour. Ind. Eng. Chem.*, **13**, 527 (1921); Harry N. Holmes, "Laboratory Manual of Colloid Chemistry," 104 pp. (1922).

[2] W. D. Bancroft, "Applied Colloid Chemistry," 161 (1921).

Here are two sentences,[1] "Clays can be obtained so finely divided that they can make true colloidal solutions. Colloidal clay belongs to the class known as 'suspensoids' and is reversible, that is, the particles can be dispersed in water or thrown out of colloidal solution by means of suitable electrolytes."

Within the extreme meanings of these words, no question can be raised as to their accuracy. A small portion of plastic clay can be obtained that approaches "true colloidal" solution but the only clay (Bentonite) in which a predominating proportion approaches anywhere near the true colloidal solution *state* has low bonding strength and does not add to the plasticity or bonding strength of any clay or ceramic mixture. It has adhesiveness but lacks cohesiveness. Any or all portions of any clay, the coarser grains of which are high in "clay substance" (as determined chemically), will be about as plastic and have about as high strength as the clay had before removal of the portions that approach "true colloidal solution."

The clause quoted from Schurecht reading "the particles can be dispersed in water or thrown out of colloidal solution by means of suitable electrolytes" is true in reference to such colloids as ferric hydroxide, which can be had in all stages from clear solution to gelatinous mass, but in reference to coagulation of suspended discrete particles of clay of sizes too large to be classed as colloidal, this clause gives an exaggerated picture of the case, and gives emphasis to the portion of clay which is non-essential to plasticity.

Accuracy in science is essential and so scientific statements must be, not only as to wording but also in possible interpretation by those for whom the statements are written. It seems to me nonsensical to use terms that are only approximately true in reference to the smaller portion of the clay and that too to the portion which is non-essential to the development of plasticity. It certainly gives a wholly incorrect vision of clay to say "clays can be obtained so finely divided that they can make true solutions."

It certainly does not plumb with the whole truth to say that "colloidal clay belongs to the class known as suspensoids and is reversible," for the portions not classed by size of their particles as colloidal are also reversible in the sense that they can be flocculated and deflocculated. Then too most of the fine particles that are correctly styled as colloid are at the coarse end of the colloid scale.

I grant today, as I did in 1910, that the fine clay particles come under the classification of colloid, but since the size of particles in clays are discrete and do not coalesce, and since the majority of them in most plastic clays are too large to be styled colloidal, why not characterize them as

[1] H. G. Schurecht, "The Use of Electrolytes in the Purification and Preparation of Clays," Bur. Mines, *Technical Paper* **281**, 1922.

particles (which they all are), rather than as colloids. Why give the whole collection of particles, comprising the clay, the characterization of the minor portion, especially when the colloidal portion are particles of the same sort as those of the major portion of the clay.

Since we strive to have the language we use convey most exactly our conceptions, I propose the following substitution of words when discussing clays: (1) deflocculated for sol; (2) flocculated for gel; (3) clay suspension for colloidal solution; and (4) deflocculated for dispersed.

"Set Gels."—What in clays can be styled "set gels?" Does this refer to dehydrated clay particles? If so, why the use of the words "set gels?" When clay is subjected to increasing heat treatment, the water and volatile gases are driven off, making more than a change in *state;* it is a change in substance and the dehydrated clay particles dehydrated are not of the same substance they have been. This is not a case of "set gel."

Colloids in Clays.—The colloids in clay effecting plasticity are discrete particles of hydrous silicate of alumina some of which are bundled together into coarser particles that resist disintegration by water. When a clay is made up of various sizes of "particles," the coarser ones of which are cemented agglomerates of small particles, the mass as a whole will exhibit that which we call plasticity. The larger bundles of particles will have the same adsorptive power per surface exposed and react physically with electrolytes to the same degree as will the small discrete particles. Hydration and hydrolysis of the clay substance breaking down into hydrates of alumina and silica are not necessary to an explanation of flocculation and deflocculation.

Cause of Plasticity.—In general my ideas are as stated in 1909.[1]

"Plasticity is the result of purely physical conditions and properties—adsorption, solution, molecular attraction and high surface tension." These cause the particle when wetted to hold a water saturated film. For the mass to exhibit plasticity, the particles must not be separated one from the other beyond the range of molecular attraction, one with the other, which range is sufficient to permit each to retain its maximum water envelope. Experiments have shown that the volume of water required to render a clay mass plastic is equal to the volume of water required to fill the pores when the formed mass has been dried, plus the water required to give each and all particles (or bundles of particles) its maximum water film. This salt solution film is the "slippery medium" and when the mass is dried these salt coatings are the cementing agents and when subjected to heat treatment they are the sintering media. Flocculation and deflocculation occur in response to relative difference in surface tension of the excess water, *i. e.*, water in excess of the total re-

[1] *Trans. Amer. Ceram. Soc.*, **11**, 588 (1909).

quired to render the mass plastic, and the surface tension of the water film. I called this a difference in potential, and my conception is that clay particles flocculate when the potential of the water envelopes is less than that of the excess water and they deflocculate when the potential of the water envelopes is greater. The greater surface tension of water envelope not only results in deflocculation but also requires less excess water to give the clay mass the same degree of plasticity. When the mass is in sufficient amount of water to allow free movement of particles, a condition known as "slip," the particles will flocculate as the surface tension of the excess water is increased. This explains why a small portion of salt deflocculates (it all goes to the films by adsorption) and excess of this amount of salt again flocculates.

I have given a colloid theory of plasticity in terms that describe exactly what happens. My explanation of the cause of "happenings" may contain some errors but the terms used mean just that and only that which I intend. They are not misleading.

NOTE ON THE RELATION OF THE STRUCTURE OF CLAY GRAINS TO THE PLASTICITY OF CLAYS

By H. G. Schurecht

It is undoubtedly true that the fine-grained kaolinite aggregates, or "bundles" of clay particles as Mr. Purdy calls them, exert an important influence on the plasticity of clays. It has been shown by microscopic examination[1] that most clays consist of aggregates of fine-grained kaolinite particles rather than coarse individual ones. The proportion of the clay which is readily deflocculated does not represent all of the extremely fine clay particles, since a certain portion is usually present in certain aggregates which are not affected by electrolytes.

The writer found that by agitating many clay slips, in which the clay grains were composed of fine-grained kaolinite aggregates which were not affected by electrolytes, for different periods of time, they became finer-grained upon increasing the time of shaking. With some clays a maximum degree of fineness is not obtained after continued shaking for three days. Since these aggregates may be disintegrated by agitation, it is evident that they are only loosely cemented together. Such grains impart plasticity to clays, while the firmly cemented aggregates found in flint clays which do not disintegrate by agitation in water do not impart plasticity to clays. All other things being equal, clays consisting mostly of loosely cemented aggregates of fine-grained kaolinite are more plastic than those composed of coarse crystalline kaolinite particles or firmly cemented aggregates of

[1] "The Microscopic Examination of the Mineral Constituents of some American Clays," *Jour. Amer. Ceram. Soc.*, **5**, 6–7 (1921).

fine-grained kaolinite. The presence of these loosely cemented aggregates of fine-grained kaolinite also explains why some of the clays still have considerable plasticity after the fine suspended clay is removed, while others like the Spruce Pine, N. C., kaolin, which is composed almost entirely of coarse crystalline kaolinite particles, have very little plasticity after the fine suspended material is removed.

In addition to the cemented aggregates of fine-grained kaolinite, clays also contain flocculated aggregates of fine-grained kaolinite which exert an important influence on the plasticity of clays. The writer has shown[1] that by adding 1–2 per cent alkali to plastic clays, their plasticity is greatly decreased, due to deflocculation, and their dry strength increased, while acids function oppositely. All other things being equal, those clays having the largest proportion of flocculated fine-grained kaolinite aggregates are more plastic than those having larger proportions of deflocculated clay particles and *vice versa*. By flocculated clay particles the writer means those which are capable of being readily deflocculated by the addition of alkalies.

The writer found[2] that it is possible to deflocculate a larger percentage of the extremely fine kaolinite particles, *i. e.*, below 0.0001 mm., which are considered colloidal, from ball clays than from kaolins. This would indicate that the flocculated aggregates of fine-grained kaolinite particles in the ball clays are composed of finer-grained kaolinite particles than those in the kaolin. It is, therefore, probable that the greater plasticity of ball clays as compared with kaolins is partly due to the fact that the flocculated aggregates in ball clays are composed of finer-grained kaolinite particles than those in kaolins.

It was also found that the properties of ball clays are changed much more by the addition of electrolytes than are the properties of kaolins. For example,[3] the writer found that by adding 1.5 per cent NaOH to a ball clay in the plastic state, its dry strength was increased about 400 pounds per square inch, while the dry strength of Georgia kaolin could be increased only about 75 pounds per square inch by this treatment.

Mr. Purdy states in the opening discussion that by speaking of the colloidal clay particles[4] the writer referred to that portion of clay which is non-essential to plasticity. Since the writer has found that the plasticity of many clays is affected by the initial alkalinity or acidity of the clays and since those clays having the larger proportion of extremely fine-grained

[1] "The Use of Electrolytes in the Purification and Preparation of Clays," U. S. Bureau of Mines, *Tech. Paper* **281,** 28–29 (1921).

[2] "Sedimentation as a Means of Classifying Fine Clay Particles," *Jour. Amer. Ceram. Soc.*, **4,** 818 (1921).

[3] U. S. Bureau of Mines, *Tech. Paper* **281,** 28–29 (1921).

[4] *Ibid.*, **281,** 5 (1921).

kaolinite particles are more affected by electrolytes than those composed of coarser individual particles, it seems that the fine particles in clay do play an important part in the plasticity of many clays, although it is not the only factor influencing plasticity.

The fineness of grain of the particles in the loosely cemented aggregates of fine-grained kaolinite in clays is also important and undoubtedly has an important influence on the plasticity.

In summarizing, the writer wishes to suggest the following factors which influence the plasticity of clays. It is assumed in the following that all other things are equal except the two factors cited in each case.

1. Clays composed of loosely cemented aggregates of fine-grained kaolinite are more plastic than those containing firmly cemented aggregates of kaolinite particles (*i. e.*, aggregates not disintegrated by agitation with water).

2. Clays composed of loosely cemented aggregates offine-grained kaolinite are more plastic than those composed of coarse crystalline kaolinite particles.

3. Clays composed of flocculated aggregates of fine-grained kaolinite are more plastic than those composed of deflocculated particles of kaolinite.

4. Clays consisting of aggregates which are composed of extremely fine-grained kaolinite particles are more plastic than those in which the aggregates are composed of coarser kaolinite particles.

5. Clays composed of flocculated aggregates of fine-grained kaolinite are more plastic than those composed of cemented aggregates of fine-grained kaolinite.

In the above comparison the writer has selected the extreme cases in which only two factors vary to simplify the comparison, while as a matter of fact, all of these factors may exert their influence on most clays in different degrees, hence causing the widely different properties of clays in their plastic state.

In conclusion, the writer wishes to state that the above statements are not positive conclusions, but merely opinions based upon a limited amount of laboratory work, under which condition the writer was asked by Mr. Purdy to discuss this subject.

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DISCUSSIONS ON "NEW DEVELOPMENTS IN OXY-CHLORIDE STUCCO AND FLOORING"[1]

By Max Y. Seaton:—The paper on "New Developments in Oxy-Chloride Stucco and Flooring," by Shaw and Bole, is unquestionably of interest to the chloride industries, for it deals with investigations on the

[1] Shaw and Bole, *Jour. Amer. Ceram. Soc.*, **5**, 311 (1922).

two basic raw materials employed in the manufacture of products having a value of between ten and fifteen million dollars yearly. It appears to the writer, however, that the paper is to some extent misleading in presentation. The authors premise that the two main defects in the current oxy-chloride practice are high cost and poor quality of the products, and present certain data on methods and materials which are expected to remedy these conditions; yet on the basis of their own figures no cost reduction will result from one of their proposals, while the other, although of a more promising nature, when considered in the light of past investigations and of recent practice does not offer any immediate hope for either cost reduction or quality improvement.

These authors first propose that calcium chloride be used to replace magnesium chloride in oxy-chloride cements. Study of the table submitted shows that when calcium chloride is used, attractive strengths are only obtained in neat mixes or in mixes far higher in magnesium oxide content than those used in the field. Neat oxy-chloride cement is never used in practice, and the fact that a calcined magnesite mixed with calcium chloride sets firm and hard while a similar neat cement using magnesium chloride is not as attractive physically is without meaning from a practical standpoint. The increase in magnesium oxide, required in all of the calcium chloride cements described, far more than offsets any cost saving brought about by substitution of calcium for magnesium chloride.

The second proposal, that magnesite be replaced by dolomite in oxy-chloride cements, is of somewhat more interest. This subject has, in fact, engaged the attention of investigators for many years. Patents to Clark[1] in 1881, to Billwiller[2] in 1915 and to Mitchell[3] in 1918 show the trend of thought in this direction. The decomposition of dolomite on heating and the development of free lime have been followed by various investigators, notably by Kallauner,[4] while the quantitative effect of free or active lime on the properties of oxy-chloride are discussed quite fully in a previous paper by the writer.[5] The patents above particularly refer to the regulated burning of dolomite, but other methods for the recovery of its magnesium oxide content have had much attention. The separation of magnesium from calcium in burned dolomite rocks is, of course, common practice in the insulating magnesia industry, and is carried on also in the commercial manufacture of magnesium chloride. More recently Schurecht[6] and Eyoub[7]

[1] Brit. Pat. 1720 (1881).
[2] U. S. Pat. 1129060 (1915).
[3] U. S. Pat. 1273110 (1918).
[4] *Chem. Ztg.*, **37**, 1317 (1913).
[5] *Chem. and Met. Eng.*, **25**, 270.
[6] *Jour. Amer. Ceram. Soc.*, **4**, 558 (1921).
[7] *Eng. & Min. Jour.*, **112**, 619 (1921).

have studied the leaching out of lime by water from burned dolomite. All these methods are intended to give a product eventually suitable for use in the oxy-chloride industries.

Shaw and Bole mention a special method of preparing dolomite by which the occurrence of free lime is avoided, but give no details of process and no intimation as to probable cost. Laboratory preparations of specially treated dolomites using at least three different methods have been extensively studied under the writer's direction, but although all such methods produce a product of fair quality, the production cost outlook is by no means clear. The future of commercial production of dolomite for the oxy-chloride industries must depend on the economies of the process and of the transportation situation, for it must not be overlooked that a burned dolomite carries two parts of inert filler to one part of magnesium oxide and must be freighted to point of consumption. A cheap and satisfactory filler is usually available locally to an oxy-chloride manufacturer.

Messrs. Shaw and Bole's remarks on the tests of their prepared dolomites made by the Dow Chemical Company, although unquestionably correct when these tests were made in 1920, cannot be applied today to commercial magnesite production. In water resistance tests a 50% recovery is not considered passable today. The plant specifications of one producer[1] require in fact a recovery of 100%, a value which neither of the dolomite products reported approach.

Oxy-chloride cement failure, traceable to faulty magnesite, has unquestionably often occurred in the past, but modern methods in calcining practice have eliminated the majority of such difficulties. A failure of oxy-chloride products in the field may be due to faulty ingredients, faulty proportions or faulty workmanship. Only when great attention is given to each factor is success assured. The principles of aggregate proportioning in oxy-chloride cements are but little understood, and failure frequently results from the use of improper mixtures even when all the ingredients used in the mix are of satisfactory quality.

By Robt. D. Pike:—In discussing Messrs. Shaw and Bole's paper my remarks will be based largely upon some experimental work with which I have been connected. Although this work was principally concerned with magnesite we did some work with a dolomite from Owens Lake, California, having the following analysis:

Insol.	0.55
Fe_2O_3	.00
Al_2O_3	.15
CaO	30.40
MgO	22.60
Ig. Loss	46.04

[1] The Sierra Magnesite Company, Porterville, California.

We first produced a calcined product containing 17.5% water soluble lime. This material, when mixed with aggregate and gauged with $MgCl_2$ sp. gr. 1.19, was entirely worthless as a cement. We then prepared this same dolomite so that when all of the $MgCO_3$ was calcined there was present less than 1% of water soluble lime. This latter material was ground, mixed with Ottawa standard sand in the proportion of 3–5 by weight, and gauged with the same $MgCl_2$ solution. When normal consistency was reached the ratio $\frac{MgCl_2}{MgO}$ was 0.349. Incidentally this dry mix contains the same per cent of MgO as a 1–2–5 mix, made up from 85% calcined magnesite, the figures referring to the respective weight percentages of calcined magnesite, Silex, and standard sand. This mix gave a cement having the following properties:

Initial set	2.11 hrs.
Final set	3.26 hrs.
Tensile strength	24 hrs., 379 lbs. sq. in.
Tensile strength	7 days, 569 lbs. sq. in.
Tensile strength	28 days, 589 lbs. sq. in.

The test for water resistance was crude, but indicated that this property was satisfactory.

These results seem to confirm the findings of Messrs. Shaw and Bole insofar as the latter relate to cements gauged with $MgCl_2$ and it appears likely that a pound of MgO in a properly prepared dolomite will be as valuable as a pound of MgO in calcined magnesite, at least when we consider the lean mixes employed in stucco manufacture, but we cannot accept this as a final conclusion applicable to actual practice, until we have gathered a considerable additional amount of data covering not only laboratory but field tests.

We only experimented with the use of $CaCl_2$ to a limited extent, but our results were not favorable to its use. The results obtained with $CaCl_2$ by the authors of this paper are surprisingly good, but even so they do not indicate that this cheaper material will eventually replace $MgCl_2$ because it gives inferior results in all but the neat magnesite mixes, which latter are not commercially practical. The action of these mixes is puzzling and holds interest from a theoretical view-point.

One of the main conclusions of our experimental work was that the principal independent variable affecting the quality of calcined magnesites is heat treatment, the term implying a combination of the factors, temperature of calcination, temperature to which the material is raised immediately after calcination, and the time of residence of the material in the calcining furnace. Incidentally the significance of the first mentioned factor is doubtful, because calcination is an endothermic process which proceeds actively at a given temperature, and the last two factors are probably

the significant ones in determining the properties of the finished material. It has also been noted that with the purer grades of magnesite, the so-called calcining temperature, *i. e.*, the temperature observed in the calcining zone of the kiln, should be between 900° and 1000° C to give the best results, all things considered.

It occurs to me that these facts possibly bring out a serious objection to the Shaw-Bole process, in which the temperature of calcination and the heat treatment of the product must be governed by consideration of the dissociation pressure of calcium carbonate, and cannot on this account be over 700° C, using the authors' figure, whereas experience with pure magnesites containing little or no Fe_2O_3, and in this important respect comparable with the dolomite, indicates the desirability of a calcining temperature of over 900° C, which would render the dolomite worthless because of the presence of free lime.

As the authors have pointed out in the final analysis economic consideration will govern. In this connection I have developed a simple formula for showing the relative value of magnesite and dolomite based upon the assumption that the value of unit weight of MgO is the same in both.

$$C_1 = \frac{M_1F_2 - M_2F_1 + M_1C_2 - V(M_1 - M_2) - P(M_2 - M_1)}{M_2}$$

The symbols with some approximate values follow:

M_1 = proportion MgO in dolomite = 0.27.
M_2 = proportion MgO in magnesite = 0.80.
C_1 = cost producing ton of dolomite ground ready for use at plant.
C_2 = same magnesite.
F_1 = freight rate per ton on dolomite from factory to point of use.
F_2 = same for magnesite.
P = cost of packages per ton.
V = value of aggregate at consuming point.

To compare the economic value of these two materials take a hypothetical case. Suppose that—

C_2 = \$30 (California Magnesite).
F_2 = \$16
P = \$ 2
V = \$ 3
F_1 = \$ 3

Then C_1, the cost of producing dolomite to put it on a parity with California magnesite, assuming that the former must stand only \$3 per ton freight, as compared with \$16 for the latter, would be \$12.50 per ton. In short, under the assumed conditions the cost of producing the specially calcined dolomite, ground in bulk must be \$12.50 per ton to be on a parity with magnesite.

The experimental work to which I have referred was a coöperative research between United States Bureau of Mines and Northwest Magnesite Co. into the preparation and properties of caustic burned magnesia carried out during 1920–21 at the Berkeley station of the Bureau.

By G. A. Bole: We found the optimal temperature for calcining dolomite to be between 700° and 800° C at which temperature the dissociation pressure of the calcium carbonate is considerable, as pointed out by Mr. Pike, but so long as the calcination is carried out in an enclosed space the calcium carbonate will not dissociate until the temperature reaches nearly 900° C—the temperature at which the dissociation pressure reaches one atmosphere.

All of our semi-commercial (ton lots) calcinations were carried out at a temperature of 750° C and none of them showed as much as 1% free lime. This was, of course, due to the fact that the material was under an atmosphere of carbon dioxide.

The cost of calcination lay well within Mr. Pike's estimate of $12.50 per ton.

By H. G. Schurecht: In the utilization of dolomite for oxy-chloride cements, the presence of free calcium oxide seems detrimental as Bole has pointed out. The writer, under the direction of Mr. R. T. Stull, experimented with dolomite cements prepared by calcining dolomite between 770–800° C and produced an inferior cement which never did get very hard. By calcining the dolomite at a lower temperature in an atmosphere of CO_2, as Bole recommends, the formation of free lime is prevented. However, this product has approximately 71.2 per cent $CaCO_3$ which exerts no cementing action and contains only 28.8 per cent of cement.

The writer conducted experiments on dolomite cements by calcining them to 1000° C, *i. e.*, to decompose both the $CaCO_3$ and the $MgCO_3$. The CaO was then converted to $CaSO_4.xH_2O$ by treatment with $MgSO_4$-$7H_2O$. The product was then recalcined which converted the $CaSO_4.xH_2O$ into Estrich plaster and hence a cement was produced in which both a magnesia oxychloride and Estrich plaster reaction were involved.

In a second series of tests the dolomite after calcining at 1000° C was ground with kaolin calcined at 700° C in a proportion as follows: 1 mol. of Al_2O_3 $2SiO_2$ to 1 mol. of $CaMgO_2$. The free lime in this case combined with the clay to form a water resisting cement. Blast furnace slag and basic hearth slag were used in the place of calcined kaolin with good results.

These cements differ from the type described by Bole and although the experiments were not carried through to completion they appear promising since the cementing properties of the calcium is taken advantage of instead of allowing a large percentage of inert $CaCO_3$ in the cement.

DISCUSSION ON "FIRE CLAYS OF THE EASTERN COALFIELD OF KENTUCKY"[1]

By A. M. Miller:—It is an admirable presentation of the subject, summing up well the results of previous investigation, and giving additional facts brought out by the recent examination of the field by the author of the paper.

If I may be permitted to defend my own views as to the age of this flint fire clay of that region, I would present the following facts for consideration.

1. In passing northeast along the western margin of the eastern coalfield in Kentucky, the Chester series becomes thinner and the upper members of it, especially, are apt to drop out, the Pottsville then resting on lower members of the series.

2. The exposures of the fire clay along the north fork of the Licking, one of which is the Blair's Mill exposure, is southwest of the Carter County exposures. They are evidently all of the same bed despite the fact that the quality of the clay as a refractory material may differ in the two regions.

3. At one place, the Blair's Mill exposure, the clay is undoubtedly interstratified with Chester, though only a few hundred yards away it is immediately overlaid with the Pottsville conglomerate.

4. One single case of interstratification of the bed with Chester would seem to fix its age as Chester, no matter if anywhere else to the northeast it is immediately overlaid with the Pottsville. For this laying down of the Pottsville on lower and lower beds of the Chester (and indeed in the absence of the latter on lower beds of the remainder of the Mississippian) is just what is to be expected from the thinning of these upper beds of the Mississippian as the formation is traced to the northeast.

DISCUSSION ON "MICROSCOPIC STUDY OF GROUND COAT AND COVER COAT ENAMEL REACTIONS"[2]

By R. R. Danielson:—Mr. Geisinger has made a very interesting as well as a valuable contribution to the literature on enameling. He has brought out very nicely the relation of the structure of the enamel to its ability to remain intact under the compression to which ordinary steel enamels are subjected. In our study of gray ware enamels we have noted that those enamels which show blistering from an excess of salts in the dipping operation do not usually develop fish scaling although they normally do scale.

We have also found that enamels which are under great compression

[1] H. Ries, *Jour. Amer. Ceram. Soc.*, **5**, 397 (1922).

[2] E. E. Geisinger, *Ibid.*, **5**, 322–37 (1922).

because of their low coefficient of expansion as compared with that for steel, will shiver and flake off in large patches when overfired although when properly fired they develop only typical small scales. It would, therefore, seem that the shivering Mr. Geisinger describes is an exaggerated development of the fish scale which occurs in the form of the typical scale when the enamels are properly fired. Another factor which may have caused shivering in Mr. Geisinger's work is the steel which for his purpose is of comparatively heavy gauge, thus tending to place the enamel under still greater compression.

By E. P. Poste:—It is very gratifying to realize that the rather general observations, reported by the writer,[1] have stimulated a sufficient interest on the part of the author of the present paper to bring forth a much more elaborate application of the study of enamels under the microscope.

We note that the author uses the terms "shiver" and "fishscale" as referring to different types of trouble. In general, we are of the impression that the term "shiver" has been used in connection with glazes applied to earthenware or other bodies, while the word "fishscale" has been used in connection with enamels, more particularly those applied to steel, and we are quite certain that many enamelers when using the word "shiver" think of it as synonymous with "fishscaling."

Apparently the author uses the word "shivering" to refer to the flaking off of the upper coat of enamel, leaving in a very porous condition some enamel adhering to the steel.

We are not criticizing this usage of the terms but feel that the author's point of view should be thoroughly understood in considering the paper.

The observations of the writer check the statements of the author as regards the general nature of the burning of enamel. The early stages of the process involve the solution of unfused material, while in the latter stages and certainly in over-burning, certain reactions take place which give rise to the formation of bubbles. It is probable that with the average steel enamel no one point in the burning involves the entire absence of unfused material and bubbles, so that the best compromise which may be adopted as a normal burn involves the presence of small amounts of unfused material and also the presence of a relatively small amount of fine bubbles.

In general we feel that the study of chips of enamel in cross section is a very fruitful field, not only as a matter of determining the conditions existing in the enamel but the possible causes of lack of adhesion of the enamel to the metal.

[1] Poste, "Enameled Surfaces under the Microscope," *Trans. Amer. Ceram. Soc.*, **19**, 146 (1917).

ACTIVITIES OF THE SOCIETY

Atta Boy!

A fisherman on the bank of a river was asked by a passer-by, "How many have you got?" "Wa-al," he drawled, "when I gits another, I'll hev one."

The membership record this month is a multiple of this story. When we get another personal membership we shall have just *twice* as many as last month, and when we get another corporation member we shall have just *three times* as many as last month. Prolonged applause.

The Terra Cotta Tigers produced a wicked wielder of the willow this month in A. F. Hotzinger. This wonder of Chicago actually brought in seven of the eleven new Corporation Members, single-handed. His record and that made by Salisbury, with his six White Wares Corporations two months ago, stand alone. The managers confidently expect that the Enamel Eagles and the Refractories Regulars will be ace-high next.

Bowman 2nd is beginning to put something on the ball besides the cover and he has brought in two Corporation Members, while Cruikshank and Stanger each scored with one.

Personal memberships are well scattered. J. S. McDowell, Tillotson, and W. S. Williams, all of the Pittsburgh Pill Pounders, have two runs apiece. Pence, Rhead, Orton, Ross, Wilkins, Hansen, Wilson, Danielson, Van Schoick, Watts, Gibson, Sweely, Turk, Worsham, Steinhoff, and Wenning, each scored once. With those who were received at the Secretary's office direct, this makes a total of 25 personal and 11 Corporation members.

We will now rise and stretch before the seventh inning. Then, let 'er go again.

New Members Received from June 1 to July 13

ASSOCIATE

Beidler, Edward R., 32 Toronto St., Toronto, Ont., Can., Gen. Supt., Interlocking Tile Co.

Bennett, A. Lee, 6512–44th Ave., S. W., Seattle, Wash., Student, University of Washington.

Chapman, William B., 50 Church St., New York City, President, Chapman-Stein Furnace Co.

Cooley, M. B., Hickory, Ky., President, Cooley Clay Co.

Crane, Raymond E., 220 Alleghany Ave., Kittanning, Pa., Vice-Pres. & Gen. Mgr., Eljer Co., Ford City, Pa.

Davies, B. H., 3528 Paseo, Kansas City, Mo., Chemical Industrial Engineer, Dickey Clay Products Mfg. Co.

Gammon, Marshal E., 1677 E. 93rd St., Cleveland, Ohio, Representative, "Brick & Clay Record."

Hain, Veit A., 6058 Harper Ave., Chicago, Ill., District Mgr., George J. Hagan Company.

Harlow, Justin E., 155 E. Superior St., Chicago, Ill., Chief Engineer, M. H. Detrick Co.

Hartzell, John L., 1708 Kenneth Ave., Arnold, Pa., American Window Glass Co.

Insley, Herbert, U. S. Bureau of Standards, Washington, D. C.

Kelley, George L., 25th Hunting Park Ave., Philadelphia, Pa., Chemist and Metallurgist, Edward G. Budd Mfg. Co.

Kimes, Arthur W., 426 Fourth Ave., Pittsburgh, Pa., Managing Editor, "National Glass Budget."

McCann, Donald M., 437 Forest Ave., Zanesville, Ohio.
Nichols, Arthur S., 1800 Farmers Bank Bldg., Pittsburgh, Pa., Chemist, Harbison-Walker Refractories Co.
Poschadel, Leonard R., 155 Garfield Ave., Milwaukee, Wis., Mgr., Propriety China Dish Mfg. Co.
Rodgers, Joseph P., 2414 Connecticut Ave., Baltimore, Md., Manager, Feldspar Dept., Products Sales Co.
Sheerer, Mary G., Newcomb School of Art, Newcomb College, New Orleans, La., Professor of Ceramic Decoration.
Shoemaker, Charles S., Arnold, Pa., Chemist, American Window Glass Co.
Snyder, George R., 3440 Louisa St., Oakland Sta., Pittsburgh, Pa., Metallurgist, Harbison-Walker Refractories Co.
Stief, W. C., The Florentine Pottery Co., Cambridge, Ohio.
Thompson, J. E., 2507 Townsend Ave., Detroit, Mich., Enameling Dept., Detroit Stove Works.
Vail, James G., 121 South 3rd St., Philadelphia, Pa., Chemical Director, Philadelphia Quartz Co.
Weaver, Robert A., 818 Finance Bldg., Cleveland, Ohio, President, The Ferro Enamel Supply Co.
Weber, Harry W., 2763 Bergman St., Corliss Sta., Pittsburgh, Pa., Assistant Supt., Vitro Manufacturing Co.

CORPORATION

Atlantic Terra Cotta Co., 350 Madison Ave., New York City (*William H. Powell, Pres.*).
Conkling-Armstrong Terra Cotta Co., 410 Denckla Bldg., Philadelphia, Pa. (*Thomas F. Armstrong, Pres.*)
Enterprise White Clay Co., Ltd., Real Estate Trust Bldg., Philadelphia, Pa. (*H. S. Donaldson, Treas.*)
Federal Terra Cotta Co., 101 Park Ave., New York City. (*De Forest Grant, Pres.*)
Gladding McBean & Co., Crocker Bldg., San Francisco, Cal. (*Atholl McBean, Sec.*)
Heidenkamp Plate Glass Co., Springdale, Pa. (*Jos. Heidenkamp, Pres.*)
O. W. Ketcham, 125 North 18th St., Philadelphia, Pa. (*O. W. Ketcham.*)
John Maddock & Sons, Trenton, N. J. (*H. E. Maddock, Vice-Pres.*)
New York Architectural Terra Cotta Co., 401 Vernon Ave., Long Island City, N. Y. (*R. F. Dalton, Pres.*)
South Amboy Terra Cotta Co., 105 Nassau Street, New York City. (*Peter C. Olsen.*)
The Wehrle Co., Newark, Ohio. (*W. W. Wehrle.*)

Sections and Divisions

ST. LOUIS SECTION

The first social affair ever held by this Section occurred at Forest Park Highlands, on Thursday, June 29, 1922. A number of ladies were present and the occasion was a decided success.

The Section met at the Highlands at six o'clock. A number of the members took a swim in the pool, after which everyone enjoyed a chicken dinner served on the porch of the Cottage.

After dinner the Section was entertained by Dr. O'Connell, of the American Museum of Natural History. Dr. O'Connell, of the Geology Department, is taking a hike around the world. She is traveling alone and had some interesting experiences to tell us.

Following Dr. O' Connell's talk the party was taken in charge by Mr. George Thomas

of the Highlands Fire Clay Company, who proceeded to show us the mysteries and wonders of the "Hall of Laughter" and various other attractions.

Judging from the noise made by the party as they rode the Slide, the Whirling Tub, the Shaking Stairway, or sat in a chair to rest, only to leap suddenly into the air, the Hall of Laughter is well named.

After an hour of hilarity the party proceeded to the Dance Hall, where the remainder of the evening was spent among the clang of the Cow Bells and the wail of the Saxophone.

W. R. Morgan, of the Evens & Howard Fire Brick Co., has been elected secretary of the Section, in place of the present incumbent who is moving from the vicinity.

A. B. Christopher, *Secretary.*

Pittsburgh District Section

At the June meeting of the Pittsburgh District Section the following official actions were taken:

It was voted to appoint J. W. Hepplewhite secretary of the section to fill the unexpired term of J. W. Wright. Mr. Wright is resigning because of the pressure of other duties which interfere with the proper dispatch of the work of the secretary's office.

It was voted that J. W. Hepplewhite should represent this Section on the nominating committee of the parent society.

J. W. Hepplewhite, *Secretary.*

Enamel Division

The Research Sub-Committee of the Enamel Division for the investigation of Cast Iron met at Cleveland, Ohio, May 12, 1922, and laid out a comprehensive program for an investigation of cast iron for enameling purposes, with special reference to the relation of the iron to blistering of the enamels.

The following outline gives the principal points to be considered in the investigation:

I. Raw Materials to Finished Casting:
   - A. Source and Analysis of Raw Materials.
     1. Pig Iron
     2. Scrap
     3. Coke, etc.
   - B. Molding Practice.
   - C. Melting Practice.
   - D. Analysis of Cast Iron.
     1. Chemical Composition
     2. Metallographic Examination
     3. Physical Tests.

II. General Treatment of Castings:
   - A. Annealing
   - B. Sand Blasting
   - C. Pickling
   - D. Welding
   - E. Grinding
   - F. Machining.

III. Treatment of Enamels:
   - A. Application of Enamel
   - B. Burning of Enamel

As a means of starting the work, it was suggested that the various points in the outline, on which there is already valuable information among the members of the Enamel

Division, be taken up with the Bureau of Standards by way of turning in all available information which members have bearing on the subject.

It is planned, as a preliminary part of the work, to have the interested members of the Division furnish samples of castings which develop blistering as well as specimens of suitable iron. These samples will be examined by the Bureau of Standards for chemical composition, metallographic structure, enameling properties when coated with several types of enamels, and such other properties as may seem desirable. In addition, it is desired to obtain a history of the castings, including all available information on the cupola charge, nature of the pig iron, etc., treatment of the casting previous to and in the enameling operations, and behavior in the enameling operations. This information will be furnished through a questionnaire to be submitted by the Committee.

In this manner, it is believed that valuable information will be obtained as to the type of iron best adapted to cast iron enameling, which will permit of further systematic studies. The Bureau has arranged to install an experimental cupola to do this work after the preliminary results have been compiled.

The Committee desires the coöperation of those interested in the enameling of cast iron.

R. R. Danielson, *Chairman*
B. B. Kahn
W. C. Lindemann
M. E. Manson
H. R. Mills
E. P. Poste
Research Committee on Cast Iron.

NOTES AND NEWS

Whiteware Studies in Pacific Northwest

The United States Bureau of Mines, in coöperation with the University of Washington, will undertake an investigation of the residual kaolins and feldspars of eastern Washington and northwestern Idaho for whiteware bodies. The work to be done will follow the lines of the kaolin investigations now under way at the ceramic experiment station at Columbus, Ohio. The work will be done in the new mines laboratory of the University of Washington at Seattle.

Georgia Clays and Bauxites

In the course of the investigation of Georgia clays and bauxites, being conducted by the Bureau of Mines at the ceramic experiment station, Columbus, Ohio, bricks were recently made from twelve of these clays, previously calcined at 1450° C. Porosities, load tests under heat, spalling tests and slag penetration tests were run on the burned bricks, some of them proving to be of excellent quality. The more bauxite clays did not make sufficiently dense bricks to withstand the load and spalling tests.

Bricks from Dolomite

At the ceramic experiment station, Columbus, Ohio, the Bureau of Mines has made standard sized bricks from calcined dolomite and from raw dolomite using 10 per cent of the flux Fe_2O_3, Al_2O_3, SiO_2. Calcined dolomite was found undesirable for making into bricks as the mud slakes so rapidly, and on account of enormous shrinkage during drying and burning, all samples cracked badly. Raw dolomite, together with 10 per cent flux, gives excellent promise. The bricks so burned to 1450° C were sound, of high density and have not yet shown signs of slaking when subjected to the boiling test.

Fluorspar Investigation

R. B. Ladoo, mineral technologist of the U. S. Bureau of Mines, recently spent a month in the southern Illinois and western Kentucky fluorspar field in order to complete the investigation of the fluorspar industry. The outstanding feature of the fluorspar situation is that our known reserves are very low, and unless new deposits are found, fluorspar will be very scarce and expensive within a few years. The development of possible substitutes is being considered. The object of the fluorspar investigation is the eventual preparation of a bulletin on all phases of the fluorspar situtiaon.

Meeting of the American Chemical Society

Pittsburgh will be the host of the American Chemical Society at its Annual Fall meeting, from September 4th to September 9th, inclusive. All of the divisional meetings will be held at the Carnegie Institute of Technology, while the general meetings are scheduled at Carnegie Music Hall.

An exceptional program has been outlined for the entire week, with a variety of social events for the Councilors and their wives.

By special arrangements, the Committee of the Pittsburgh Section of the A. C. S. has obtained dormitory privileges for the Councilors at Carnegie Tech. during the meeting. The men's dormitories will be opened to house 350. One of the women's dormitories has been offered for the use of Councilors' wives.

American Construction Council Organization Meeting

The American Construction Council was formally launched as a result of a two-day organization meeting held in Washington June 19 and 20. The meeting was attended by about 170 representatives of the various groups concerned with construction. Mr. Hoover opened the meeting with a characteristically pointed and illuminating address. This was followed by an instructive address by Mr. Booth of the Guaranty Trust Company of New York. One of the inspiring addresses was delivered by Mr. E. J. Mehren. Messrs. Townley and McClellan delivered brief addresses and otherwise participated in the conference. Mr. Townley stated that the Executive Board of the Federated American Engineering Societies had voted an expression of cordiality and coöperation. The key-note thought of each address was the great need for the formation of some agency that would have as its chief function the removal from the construction industry the many ills that it now possesses. The newly elected Executive Board is to meet with Mr. Roosevelt for the purpose of electing the officers of the Council. The program committee submitted the following as the lines of activity to be undertaken by the Council. These recommendations were adopted by the conference: (1) The formation of a code of ethics acceptable to the whole industry and to the public; (2) Gathering of adequate statistics from all sources; (3) Reduction of the national shortage of building trade mechanics and the establishment of the necessary apprenticeship system; (4) Coöperation in establishing uniform building codes throughout the country; (5) Coöperation with railways in expediting the revision of existing freight rates on construction materials; (6) The establishing and strengthening of local organizations throughout the country to bring about the coöperation of all elements in conformity with the principles of the Council; (7) The investigation of the evils of seasonal employment and migration of labor; (8) The encouragement of local building shows; (9) Simplification and the elimination of waste; (10) Education of the public as to the desirability of a better distribution of its construction and maintenance requirements; (11) Promotion of health and safety for workmen and the reduction of loss of life; (12) The reduction of waste of construction materials from preventable fires; (13) The study of old buildings in order to establish superior methods of construction; (14) The education of the public as to the necessity and economy of properly maintaining structures.

Research School in Australia

Those who are interested in the spread of research in ceramics throughout the world will be glad to note that a research center has been established by the Australian Commonwealth at the Brunswick Technical School. Experiments will be conducted and tests made at the Brunswick School of Pottery, and it is expected that this will encourage and hasten the development of the clay-working industry in Australia.

Who's Where in the American Ceramic Society

E. E. Ayars, of the American Refractories Co., has been changed from Danville, Ill., to Devil's Lake, Wis.

Lawrence H. Brown, formerly with the R. Thomas & Sons Co., East Liverpool, is now connected with the Edwin M. Knowles China Co., Newell, W. Va.

F. M. Burt, of the American Stamping and Enameling Co., has moved from Massillon, Ohio, to Westmoreland, W. Va.

A. B. Christopher, formerly of the Evens & Howard Fire Brick Co., and secretary of the St. Louis Local Section, has associated himself with the Southern Brick Co., Jonesboro, Ark.

Dwight T. Farnham has severed his connection with the C. E. Knoeppel Co., of which he has been vice-president, and has opened private offices as a Consulting Engineer at 347 Madison Avenue, New York City.

E. H. Fritz, of the Pittsburgh High Voltage Insulator Co., is now located at 609 Main St., Latrobe, Pa.

G. W. Rathjens has notified the office that he is no longer in St. Paul, Minn., but at 6106 Dorchester Ave., Chicago, Ill.

Charles F. Ryan, who has been with the Chapman-Stein Furnace Co., at Mt. Vernon, Ohio, is now with the Russell Engineering Co., St. Louis, Mo.

Fred H. Schwetye has resigned his position with the Laclede-Christy Clay Products Co. and has accepted the position of Secretary of the Grand View Fire Clay Co., St. Louis, Mo. Mr. Schwetye was in the employ of the former company for sixteen years and during the last four years was General Superintendent of the plants. In his new position he will be in charge of mines and plants of the Grand View Co., manufacturing special prepared clay mixtures for the glasshouse, zinc, and foundry trade, as well as high grade refractory materials.

B. B. Swinnerton has recently become connected with the Limoges China Co., at Sebring, Ohio.

E. W. Washburn, formerly director of the department of Ceramics at the University of Illinois, is at present in Europe. His permanent address is the National Research Council, Washington, D. C.

Calender of Conventions

AMERICAN CERAMIC SOCIETY, Summer Excursion Meeting—Montreal and Canadian points, August 13–19, 1922.

American Society of Sanitary Engineers—Cedar Point, Ohio, August 22–24, 1922.

Annual Safety Congress of the National Safety Council—Detroit, Mich., August 28–September 1, 1922.

American Chemical Society—Pittsburgh, Pa., September 5–9, 1922.

National Association of Brass Manufacturers—Detroit, Mich., September 6–8, 1922.

Association of Iron and Steel Electrical Engineers—Cleveland, Ohio, September 11–15, 1922.

Eighth National Exposition of Chemical Industries—New York City, September 11–16, 1922.

American Electrochemical Society—Montreal, Canada, September 21–23, 1922.

American Institute of Mining and Metallurgical Engineers—San Francisco, Cal., September 25–28, 1922.

National Association of Commercial Organization Secretaries—Chicago, Ill., October 23–25, 1922.

National Society for Vocational Education—Detroit, Mich., November 30–December 2, 1922.

Dental Manufacturers Club—St. Louis, Mo., November 20, 1922.

Dental Exhibit of the Dental Manufacturers Club—St. Louis, Mo., November 21–24, 1922.

National Exposition of Power and Mechanical Engineering—New York City, December 7–13, 1922.

Mining and Metallurgical Society of America—New York City, December 7–13, 1922.

American Malleable Castings Association—Cleveland, Ohio, January 10, 1923.

National Jewelers Board of Trade—New York City, January 18, 1923.

Canadian National Clay Products Association and Western Ontario Clay Workers Association—Hamilton, Ont., January 24–26, 1923.

American Concrete Institute—Detroit, Mich., February, 1923.

National Association Builders Board of Control—Des Moines, Iowa, February, 1923.

AMERICAN CERAMIC SOCIETY—Pittsburgh, Pa., February 12–17, 1923.

Natural Gas Association of America—Louisville, Ky., Spring 1923.

American Institute of Mining and Metallurgical Engineers—New York City, February 19–22, 1923.

National Association of Stove Manufacturers—Richmond, Va., May 9–10, 1923.

American Association of Museums—Charleston, S. C., May, 1923.

JOURNAL AMERICAN CERAMIC SOCIETY

Preparation of Abstracts

Every article in THIS JOURNAL is to be preceded by an abstract prepared by the author and submitted by him with the manuscript. The abstract is intended to serve as an aid to the reader by furnishing an index and brief summary or preliminary survey of the contents of the article; it should be suitable for reprinting in an abstract journal so as to make a reabstracting of the article unnecessary. The abstract should, therefore, **summarize all new information completely and precisely.** Furthermore, in order to enable a reader to tell at a glance what the article is about and to enable an efficient index of its subject matter to be readily prepared, the abstract should contain **a set of subtitles** which together form a **complete and precise** index of the information contained in the article. This requires at least one and often several subtitles even for a short abstract.

In the preparation of abstracts, authors should be guided by the following rules, which are illustrated by the abstracts in THIS JOURNAL for February and March, 1921.* The **new information** contained in an article should first be determined by a careful analysis; then the subtitles should be formulated; and finally the text should be written and checked.

Rules

1. **Material not new** need not be analyzed or described in detail; a valuable summary of a previous work, however, should be noted with a statement indicating its nature and scope.

2. **The subtitles should together include all the new information;** that is every measurement, observation, method, improvement, suggestion and theory which is presented by the author as new and of value in itself.

3. **Each subtitle should describe the corresponding information so precisely** that the chance of any investigator being misled into thinking the article contains the particular information he desires when it does not, or vice-versa, may be small Such a title as "A note on blue glass," for example, is evidently too indefinite a description of information regarding "Absorption spectra of glass containing various amounts of copper-cobalt and chromium-cobalt." General subtitles, such as "Purpose" and "Results" should not be employed as they do not help to describe the specific information given in the article.

4. **The text should summarize the authors' conclusions and should transcribe numerical results of general interest,** including those that might be looked for in a table of physical and chemical constants, with an indication of the accuracy of each. It should give all the information that anyone, not a specialist in the particular field involved, might care to have in his note book.

5. **The text should be divided into as many paragraphs** as there are distinct subjects concerning which information is given, but no more than necessary. All parts of subtitles may be scattered through the text but the subject of each paragraph, however short, must be indicated at the beginning.

6. **Complete sentences** should be used except in the case of subtitles. The abstract should be made as readable as the necessary brevity will permit.

7. The ms. of all abstracts must be typewritten and double or triple spaced.

* The rules were prepared by the Research Information Service of the National Research Council. The Society is indebted to Dr. G. S. Fulcher of the Corning Glass Works (formerly with the National Research Council) for the rules and the illustrative abstracts.

BULLETIN

of the

American Ceramic Society

A Monthly Publication Devoted to Proceedings of the Society, Discussions of Plant Problems, Discussions of Technical and Scientific Questions and Promotion of Coöperative Research

Edited by the Secretary of the Society Assisted by Officers of the Industrial Divisions

F. H. Rhead, M. C. Farren — Art
B. T. Sweely, R. R. Danielson — Enamel
J. C. Hostetter, A. E. Williams — Glass
J. S. McDowell, F. A. Harvey — Refractories
F. K. Pence, C. C. Treischel — White Wares
A. F. Hottinger, R. L. Clare — Terra Cotta
C. F. Tefft, M. B. Greenough — Heavy Clay Products

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Onondaga Pottery Co., Syracuse, N. Y.

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EDITORIALS

THE VALUE OF THE ABSTRACT SERVICE

Rendered by

The American Ceramic Society

The American Chemical Society has ten times (about 17,000) as many members as has this Society and the very large majority of these members pay $15.00 a year membership subscription, more because of the service rendered by that Society in abstracting the worlds' literature on general and applied physics and chemistry than because of any other service. In order to render this service of abstracting their Society must maintain a virile, progressive organization, promoting and discovering facilities for research. To retain this position of authority it is absolutely essential to hold conventions, to maintain Industrial Divisions, to establish and to invigorate local sections, to be engaged in the compilation of monographs, etc., and in many other ways to promote and facilitate research. Whereas publishing abstracts of the worlds' current literature is but one of the many activities made possible by the organized coöperation of so many, it is the one service that is considered by most of the members as being worth more than their membership subscription.

The American Ceramic Society is engaged in this same sort of work but limiting its activities to the promotion of ceramic research. There is in this Society as in the Chemical Society that same need of well-organized

activities to make possible the publication of original literature and the abstracting of ceramic literature. This Society is obligated to its larger sister organization for an exchange of facilities for abstracting, an exchange which has been far from balanced, the Chemical Society rendering the much larger service. It nevertheless is true that as the American Ceramic Society has grown in strength and has increased its activities, the abstractors have increased their output until now the exchange between the two Societies is about 50–50.

Now as to the value of this service. We have repeatedly said that it was worth more to corporations than the total fees paid by them as corporations and for personal memberships of their employees. Here is concrete evidence: One person mailed 900 cards to this office each card showing an abstract of a published article. The package was insured for $2000. In a letter the member said that $2000 would not measure the loss he would sustain if they should not be returned.

Many corporations employ abstractors and go to the expense of printing and distributing among their employees those abstracts that are of direct value in their work.

These citations show that the monetary value of abstracts exceeds many times the membership fees paid to a Society that is sufficiently well organized and activated as to produce and publish each month an average of 135 to 150 abstracts. This is but a single part of what the members of this Society are receiving for the small membership fee of $7.50 for personal and $25.00 for corporations.

THE "WHAT FOR" OF THE AMERICAN CERAMIC SOCIETY

Does It Conflict with Trade Associations

A little while ago a prominent manufacturer asked if the Trade Association, of which he is an officer, was not engaged in the same work as the American Ceramic Society.

The first answer was Yes, in part.

One of the Industrial Divisions is working on the same problems as is his particular Trade Association with this difference—the Industrial Divisions of the American Ceramic Society bring together on one program of activities representatives of all the research agencies, collegiate, federal, state and industrial, with the trade associations and users of ceramic products.

The second answer was No.

In the first place, each Industrial Division of the Society is coöperating and coördinating with all industrial ceramic groups, each Division well organized and each working not only on its own distinctive and special problems but also on the many problems that are of common interest.

In the second place, the Society publishes monthly the results of investigations made in the several laboratories, and also discussions on plant problems, an undertaking which is quite foreign to the scope of trade associations.

In the third place, the Society publishes each month an abstract review of the worlds' literature of interest to ceramists. This service to the technical men employed in plants and by trade associations is alone worth all the financial support required to maintain the activities of this Society.

Then, in the fourth place, the Society is especially organized and equipped for the task of coördinating ceramic research activities of all ceramic groups in the technology and science of ceramics and for the publishing of the findings made in each of the researches. The trade associations are organized and equipped especially to secure and maintain cooperation of a group of manufacturers of the same sort of product on such problems as trade, traffic, tariff and accounting—the business problems. The technical organization would make a poor shift with the business problems, and, without the coöperation of a scientific organization the trade associations would make a poor shift with research in the technical and scientific problems. It is necessary that trade associations employ the personnel and facilities of a technical and scientific research organization, such as are found in the federal bureaus and in collegiate institutions.

It is absolutely sound economically that trade associations be engaged in technical and scientific researches in coöperation with the federal bureaus and the colleges. It is absolutely essential too, that each trade association maintain a "Technical Research Committee." The economies of such organized technical research activities are principally twofold: (1) the industrial executives learn the need and value of technical research, thus assuring plant application of the findings, and (2) each trade group confines its researches to problems of immediate manufacturing concern to that group.

Where does the American Ceramic Society come in as an essential in this program of research other than as a central publishing agency, owned and controlled jointly by all the ceramic groups?

Here is the answer: There are many agencies now working in ceramic science and art; but except for their contacts through the American Ceramic Society, these several agencies are without any attempt at coordinating their activities, or the results of their undertakings. Without the American Ceramic Society in which the research organizations and the manufacturing groups have a common interest and responsibility, there would be wastage and duplication of efforts and their would be no gleaning and publishing of the worlds' knowledge in ceramic science and technology. This is often spoken of collectively as the educational enterprise of the Society.

It is fairly certain that there are many problems deserving attention which are not receiving the attention of the research committees of the trade associations. There are fundamental problems of which universities could most effectively be engaged but to which their attention would not be drawn except through close contact with the industrial representatives in the Society. No trade association or research organization can undertake at one time more than a limited number and scope of research activities whereas each manufacturer has many urgent problems on which coöperation with other manufacturers or other agencies is valuable if not vital.

It is certain that there is value in coördination in technical research by the several ceramic groups, which groups, though diversified, have many problems in common. There are many manufacturing problems deserving attention which are not being studied in systematic coöperation. It is the function of the committees of the American Ceramic Society not only to bring these to the attention of competent research agencies but to follow through the solving of them, bringing to their solution the very best minds and knowledge.

The largest and most important functions of the American Ceramic Society are (1) to establish and maintain the mechanisms by which the several research agencies and the several industrial groups may have coördination and coöperation, not two by two, but all together, the ceramic crafts and ceramic laboratories jointly; and (2) to establish (in the words of Dr. Angell) "assurance of both continuity and community of programs, prompt interchange of findings, especially for purposes of educational training, expert assistance, and, in general, the services of a central body, intelligently in touch with a great variety of undertakings, all of which converge upon the fundamental problems" of all ceramic industries.

This Society does not duplicate the work of trade associations in technical research, for the part taken by the Society in such enterprises differs radically from that of the trade associations. Time has gone when a single manufacturing concern can afford to carry on research in isolation; contact must be had with other concerns through persons or organizations. By the same tokens we recognize that trade associations, universities and federal bureaus can not successfully work in isolation on technical and scientific problems in ceramic manufacturing. There is a need (becoming more and more felt) for a central clearing organization.

The field for and scope of the activities of the American Ceramic Society is clearly defined. It will not engage on problems other than technical and scientific. It will not finance nor be directly interested in the financing of research work. It is an institution organized especially to assist all ceramic research agencies, at no time nor under any circumstances assuming a dictatorial prerogative but ready to direct when called upon, serving most essentially as a general coördinating agency for all of the specialized ceramic

research agencies and industrial groups, and an educational institution alike for the technologist, the scientist and the plant operator.

The Society does not duplicate nor conflict with trade associations in technical research activities; the interests of each are supplementary.

CHEMICAL EXPOSITION SPEAKERS

EXPOSITION OF CHEMICAL INDUSTRIES, GRAND CENTRAL PALACE, NEW YORK

That portion of the program for the Eighth National Exposition of Chemical Industries which will be held during the week of September 11–16th at the Grand Central Palace, New York, that has been definitely arranged, contains the names of a number of well-known speakers. Herbert Hoover, Secretary of Commerce, and frequently referred to as "the business man of the Cabinet," will speak on the subject:—"Standardization and What It Can Do for the Chemical Industry."

Other addresses thus far scheduled on the partially arranged program of the 1922 Chemical Exposition, include a number of particular interest to the ceramic industry of the United States. The Standardization Program, to which one whole afternoon session of the program will be given, will include the following speakers: W. D. Collins of the United States Geological Survey on "Moderation in Standardization;" N. F. Harriman of the United States Bureau of Standards on "Standardized Testing Apparatus;" I. G. Jennings, general representative of the Glass Container Association on "A Discussion of the Reasons for the Varieties of Shapes and Sizes;" J. M. Roberts, Secretary of the Apparatus Manufacturers Association of the United States, on "What Has Been Accomplished in the Standardization of Scientific Apparatus;" Ross C. Purdy, Secretary of the American Ceramic Society, and Chairman of the Committee C–8 on Refractories of the American Society for Testing Materials, on "Standardization of Fire Clays and Refractories;" Emerson P. Poste of Elyria Enameled Products Co., on "Standardization of Enameled Ware for Chemical Industries."

Speakers for other groups of chemical and allied associations will take part in these programs.

Other afternoon technical and business sessions will be under the direction of the American Ceramic Society, the Association of Synthetic Organic Chemical Manufacturers of the United States, the Technical Photographic and Microscopical Society, and the Salesman's Association of the American Chemical Industry, the time for which meetings has not as yet been set. All sessions will be held in the special Grand Central Palace Auditorium. The motion picture program which will be held in the evenings exclusively, now has on it the following: "The Story of Asbestos," four reels, by courtesy of the United States Bureau of Mines and the

Johns-Manville Co.; "Preparation of Nickel and Securing Copper as a By-product," four reels, by courtesy of the International Nickel Co. accompanied by discussion; "The Romance of Cotton," one reel, accompanied by discussion by Dr. David Wesson; "Prospecting for Gold in Northern Ontario," two reels; "Assaying for Gold in Northern Ontario," one reel; both courtesy of the Ontario Department of Mines. Numerous other details of the Exposition program have been arranged tentatively and as soon as definite confirmation can be obtained, they will be announced.

THE ITALIAN MAJOLICA PROCESS AND PAINTING OVER TIN ENAMELS[1]

By Frederick H. Rhead

ABSTRACT

Reference is made to historical types. Practical conditions are discussed, types of glazes are given, and methods of application are outlined. There are also comments in connection with one-fire products.

The processes involved are discussions A-3 and A-4: "The Italian Majolica Process," "Painting over Tin Enamels," are so closely related that they are taken together.

General Outline of the Processes.—Conditions at hand, and the particular style of decoration then prevalent, determine the type of pottery made by any particular country. The Chinese happened to find unlimited supplies of kaolin, and so produced porcelains. The Italians and Persians used the available red and buff faience clays, and in order to obtain white and light colored grounds, developed opaque tin enamels and applied their decorations over these.

Sometimes the ware was glazed all over with opaque white enamel and the decoration applied over this; or a color palette, with the white enamel as a base, was prepared, and the colored glazes were painted over a modeled surface. The Della Robbia wares were executed in this manner.

Painting over Tin Enamels.—This process is much like that of underglaze painting on the bisque except that instead of painting over a biscuit surface with calcined metallic stains, the decorator uses similar stains but applies these over an unfired glaze ground. Where more brilliancy is required, a thin coat of transparent glossy or mirror glaze is sprayed over the decoration which is consequently sandwiched between an enamel and a shiny glaze. But more often, especially in the case of the Italian wares, the usual method is to simply paint over the unfired enamel and then to fire the ware to a temperature that will fuse the colors into the enamel which develops a semi-mat or smooth texture.

The Italian and Persian wares were mostly one-fire products, although it is possible that occasionally the clay ware was given a soft bisque fire to strengthen it for the glazing and decorating processes.

The Order of the Processes:

1. The ware is made of a red or buff terra cotta body and dried.
2. The ware is dipped or brushed with a level and smooth coat of the opaque tin enamel.
3. The design is drawn or stenciled over the shape and the decoration applied in the manner described in the paper on underglaze painting.[2]

[1] Discussion prepared for the Art Division of the American Ceramic Society, Twenty-fourth Annual Convention, St. Louis, 1922.

[2] F. H. Rhead, *Jour. Amer. Ceram. Soc.*, **5**, 376 (1922).

4. The ware is ready for the firing process unless a thin application of the transparent glaze is desired.

Condition of Ware to be Glazed.—Either clay or biscuit ware may be glazed with the opaque enamel. If the glazing is done in the clay state, the ware must be almost or quite dry. Any clay which will not disintegrate, blister or crack when the glaze is applied may be used. The process of glazing fragile wares is obviously a delicate one, and, where quantity production is concerned, it is a question if the loss incurred in broken clay ware does not set aside any advantages or economies derived by the elimination of the bisque fire. Personally, I like the one-fire process because I get much better surfaces and textures when the body and glaze are developed to maturity together. But this is entirely a matter of local conditions. Most of the early art and faience wares, together with some of the finest porcelains, were entirely one-fire productions, and at the present time much of the European faience and art wares (I do not refer to table and utilitarian wares) are made in one fire.

There are a number of concerns in this country also making one-fire products. I have had five years practical experience in California making ornamental wares and tile. The production averaged about one thousand pieces per week, and over ninety per cent of this was finished in one fire although the ware was very carefully made and often highly finished and expensively decorated.

Enamels, mates, underglaze decorations, lustres, and mirror glazes were used in the production of these wares. In fact, about the only practical reason a bisque firing is adopted is because it has been found practical and economical for the large production of the more fragile wares, and because it makes possible the storage of unglazed stock without incurring large losses in broken wares.

While the tin enamel and majolica processes may be done in either one or two fires, it is advisable for the beginner or average studio potter to use two fires to eliminate the danger of breakage, which always accompanies inexperienced handling.

Methods of Glazing for Painting over Tin Enamels.—Any of the known methods are practical—dipping, spraying or brushing.

For commercial work, dipping is most convenient, although certain ornamental pieces require skillful treatment to obtain a thoroughly even coat of glaze over an upright or complicated surface. For elaborate decorative work, a brushed surface using a glaze containing a strong solution of gum tragacanth may be advisable. A number of painters doing individual work prefer to glaze their own pieces.

A coating of glaze averaging about one-sixteenth of an inch in thickness is required. As a rule, a glaze containing about ten per cent or more of tin oxide need not be so heavily applied. Glazes containing less tin

oxide, and those fired to higher temperatures than cone three or four, will require heavier applications. For tile and other flat surfaces, the glaze may be applied to a thickness of almost an eighth of an inch.

The tin enamels[1] are comparatively non-flowing glazes unless there is an extreme condition of overfiring; consequently the applied surface must be level and smooth.

Methods of Decoration.—For average work, the methods suggested[2] for underglaze painting on the biscuit will apply in this process. Any of the mediums except turpentine and fat oil may be used.

In the Italian processes, the design was usually sketched lightly over the glaze and afterwards outlined with cobalt blue, manganese, or an iron brown. Almost any of the colors used in the biscuit process are practical, although it may be advisable to eliminate greens containing chrome which usually flashes or fumes the tin glaze.

Either flat or painted treatments are possible. One has only to refer to examples of Italian wares in the various museums, and also to the skillfully painted Delft wares.

Some of the Italian works of the fifteenth and sixteenth centuries were enriched with lusters applied after the glazed firing.

There have been some examples of painting over tin enamels where the glazed ware was fired before the decoration was applied. A number of European potters have produced in this manner but this ware lacks the depth and brilliancy of decorations over the unfired glaze.

Besides the underglaze colors, or calcined stains, non-flowing colored glazes of various textures can be applied to the tin enamel ground, either alone or in combination with the underglaze colors. The Persians were very skillful in their manipulation of glazes over a glaze, or slip engobe over which would be applied a light coat of transparent glaze.

The Majolica Process.—One can obtain a fair idea of this process by contrasting it with the other processes under discussion. In painting over tin enamels the stains are applied over an unfired glaze. In underglaze painting on the biscuit, the stains are painted on the biscuit body and the ware afterwards glazed. In the inlay process, the glazes are applied on the clay or bisque within a raised, flat or sunken outline. In the majolica process, the colored palette consists of colored glazes, as in the inlay process, and these are applied over the modeled surface. No outline or boundary is used.

Assuming that the decoration consists of a modeled fruit border, a typical Italian motif, the palette will probably consist of two copper greens, uranium, iron, or antimony yellows, chrome tin pinks, cobalt blues, and manganese and iron browns.

[1] *Jour. Amer. Ceram. Soc.*, **5**, 259 (1922).

[2] *Ibid.*, **5**, 376 (1922).

A gum medium is used and the colors are applied directly to the clay or bisque surface. Certain details may be accentuated by means of stains, or colored glazes lighter or darker in tone, or of greater brilliancy.

In modern commercial practice, the term majolica was applied to any type of colored glaze painting, but in these notes the wares referred to are the Italian wares of the Della Robbia type.

Of course other types of glazes may be applied in the manner described. In this country quite fine faience and terra cotta wares are decorated with colored mats treated in the same manner as were the old tile enamels, and the effects are quite as interesting so far as harmonies and soft effects are concerned. But the average mat is a non-reflecting glaze, and lacks the brilliancy and lustrous quality of the enamel. The mat glaze is obviously a beautiful and valuable decorative medium, but it is only one of the many possibilities open to the ceramic artist and decorator.

American Encaustic Tiling Co.
Zanesville, Ohio

DISCUSSION ON "THE TESTING OF SILICA BRICK"[1]

Mr. Greaves-Walker:—I am sure the expression of this division is that we appreciate the visit of Dr. Endell and his arranging to be here at the time of our Ceramic meeting. Dr. Endell is, without doubt, the leading silica brick expert of Germany and we have in this room probably all of the experts of this country, or those we class as experts—I might mention Messrs. Harvey, McGee, McDowell and Howe—and out of those four we should certainly get some discussion on the recommendations that Dr. Endell has made in regard to silica refractories. The paper is open for discussion.

Dr. Harvey:—I have been exceedingly interested in this paper—it covers the same ground, of course, in which he and I have been working for three or four years. I would very much prefer to study this paper and write a discussion on it than to attempt to discuss it finally at this time. I do not believe it is necessary to specify both gravity and linear expansion. I think if you have specified one you have covered both.

Another thing that struck me is that Dr. Endell takes one hour and a half to heat silica brick from room temperature to about 1600°C. It is our experience that if you heat silica brick as rapidly as that, you would get excessive expansion and develop cracks; linear expansion measured by that method, in our experience, is more the function of the temperature change than the degree of the conversion of the quartz.

The third fact that occurred to me is that the method which Dr. Endell uses for determining the percentages of cristobalite and tridymite seems to

[1] K. Endell, *Jour. Amer. Ceram. Soc.*, **5**, 209 (1922).

give very much higher values than we have in American brick. Therefore, as I state, before I could discuss that I would like to study the paper first.[1]

MR. ROSS:—In Dr. Endell's remarks yesterday he stated that some of the German quartzites are made of a large percentage of rather finely crystallized material which transforms more rapidly when given heat treatment than do our quartzites. That might answer Dr. Harvey's questions as to more tridymite and cristobalite.

MR. GREAVES-WALKER:—Dr. Harvey, I believe, referred to the fact that Dr. Endell got higher values in the examination of American brick than we have been able to get.

MR. MCDOWELL:—Dr. Endell's figures for American brick check rather closely those of Insley and Klein. I am not altogether sure just how closely they do agree. They are higher than the figures which I obtained about five years ago.

MR. GREAVES-WALKER:—I believe Dr. Endell obtained somewhere around 80% cristobalite in the American brick tested by him. Is that not extraordinarily high?

MR. MCDOWELL:—Perhaps Dr. Endell had Mr. Insley's figures in mind?

DR. ENDELL:—I think Insley found 75–80% cristobalite. I suppose Mr. McDowell sent to me only the best kind of American brick. In regard to our heating to 1600°C, I can say that most of our best silica bricks like the American silica bricks stand this heat treatment very well. I know there are several kinds of silica brick that do not stand this heating but the best kind do.

MR. MCDOWELL:—The brick sent Dr. Endell were commercial well-burned brick such as are now being made, and were possibly burned a little higher than was customary a number of years ago; this might have caused some difference in the microscopic analysis.

It should be borne in mind when comparing Dr. Endell's results with my own that my method is not capable of any great degree of quantitative precision. My figures were probably low, that is, the degree of inversion which I showed was probably somewhat less than the actual degree of inversion.

I doubt the practicability of specifying that silica brick shall have a definite content of the three forms of silica. Results are influenced by the method followed in making the determinations, and no method has yet been standardized. Not many petrographers have had sufficient experience in making examination of silica brick for their results to be of very great value.

DR. ENDELL:—I believe that the easiest method to determine the value of silica brick is through specific gravity.

MR. GREAVES-WALKER:—Dr. Endell, I believe the silica brick manu-

[1] *Jour. Amer. Ceram. Soc.*, 5, 218 (1922).

facturers of this country are aware of the fact that they have to adopt two different standards, one for Baraboo quartzite and one for Medina quartzite. It is possible, under some conditions, to get as low specific gravity on Baraboo quartzite as on Medina quartzite, but perhaps the products made from Baraboo quartzite would be equal to those made from Medina even if there was a difference of 0.04 in the specific gravity. The probabilities are that when figures are adopted we will have two, one for what we call Western silica and one for Eastern silica.

MR. MCDOWELL:—I believe that 2.33 is a fair average for the specific gravity of brick now being made from Medina rock.

MR. GREAVES-WALKER:—Have you not found, Dr. Harvey, that the average brick made of Baraboo quartzite will run 2.33 to 2.34?

DR. HARVEY:—Yes, the figures that Mr. McGee and I arrived at in the paper that has been spoken of showed a difference of 0.016 or, in round number 0.02. Baraboo is higher, I think, by 0.02.

MR. ROSS:—Now that you have spoken of this difference, I would like to have somebody explain why it is.

A MEMBER:—Although I have been far away from this proposition for a few years I recall the original work we did. As far as the structure and the constituents of the Baraboo was concerned, we really saw nothing that was strikingly different from that of the Medina. Our thought all along was that the changes affecting the specific gravity should go closely hand in hand, whatever they were.

MR. GREAVES-WALKER:—You probably know that brick made from Medina quartzite is generally burned at a lower temperature than Baraboo quartzite. Some few plants in Pennsylvania burn silica brick to cone 18, but in the West it is not unusual on coke oven work to burn to cone 20 and still get higher specific gravity, showing there is some physical difference. There is certainly some physical difference in type of the rock. It seems harder to bring about the same amount of inversions under the higher temperature conditions with the same length of burn. Have your investigations shown that, Dr. Harvey?

DR. HARVEY:—I am doing all the talking but McGee did all the work. We found that with the Median quartzite, brick which was burned in the commercial burn and reburned for 48 hours at 1450°C, will practically reach the limit of conversion.

With Baraboo quartzite, we found that with 2 or 3 heatings at the same temperature you do not get to the same limit of possible conversion. There is a difference in the rate of conversion. We have an extreme example of that in the quartzites of which Dr. Endell spoke yesterday, where the conversion is even more complete at a much lower temperature and a shorter time. I am not explaining to Mr. Ross why it exists, but we can not get around the fact that it does exist.

Mr. Greaves-Walker:—We have in this country those erratic quartzites of which Dr. Endell spoke. Quartzites from Flint, Indiana, will give you exactly the same results as Dr. Endell got with that one particular German flint. It is the same type of rock from which the Indians made their arrow heads. You can get a very high inversion at a comparatively low temperature, showing there is quite a difference in the rate of inversion in different quartzites.

Mr. Ross:—I think the point has been clearly brought out that there is difference in the rate of inversion, as Dr. Endell stated yesterday, in the different quartzites, some fast and some slow. It seemed to be the fineness of the size of crystals. There are certain grades of quartz throughout the country, such as from certain states in the Rocky Mountains, which have not been successfully used in the manufacture of silica brick. They have developed a punky structure which converts very fast. Is there anybody familiar with that? Is there any connection between the rapidity of transformation and structure, or are there certain impurities in those massive quartz deposits that cause the material to transform very rapidly?

Mr. Greaves-Walker:—Dr. Washburn offered a theory yesterday that was new to me, that of "colloidal quartz" which possibly may help us. When we want to explain why, we will simply tell them, "Why one is colloidal quartz and the other one is not." I am sure, Mr. Ross, I do not know. There has never been any work done on these various quartzites to find out why some of them act as they do, but we have quartz in this country that will give us 80% cristobalite in the regular commercial burn, all the way from cone 15 up to cone 20. There is a difference in their physical appearance but they are all silica—they are all of the same analysis. They appear to make the same kind of a product if they have the right kind of treatment but nobody seems to have found just why we have these differences in the rock or in the product.

By R. M. Howe[1]:—One may conclude from Dr. Endell's paper that he is primarily interested in the strength of silica brick at high temperatures and in their tendency to expand (permanently). The writer agrees with him regarding the importance of these properties but not as to the method of measurement.

Silica brick are extremely difficult to cut without fracturing and are sensitive to rapid changes in temperature, especially below 800 °C. Consequently the American practice of heating full sized brick to 1500 °C in 6½ hours appears to possess more merit than this method of heating a small specimen to a higher temperature in 2 hours. The principle of carrying

[1] Received August 9, 1922.

the test to the point of failure is worthy of consideration however, for this is successfully applied in the testing of magnesia and chrome brick under pressure. While the weaker brick are eliminated under pressure of 25 lbs. per sq. in. per $1^1/_2$ hrs. at 1500 °C, no comparison between the stronger is obtained with the standard A. S. T. M. test for silica brick. Both methods might be improved by heating full sized brick at a slow rate to the point of failure, thereby gaining the stronger points of the two practices.

Dr. Endell determines the burn of a silica brick by three different methods—measurement of the permanent expansion at high temperatures, specific gravity and micro-analysis. While all three methods are useful it is quite likely that the specific gravity test is sufficient in most cases. It is simple, accurate, and rapid whereas the micro-analysis is difficult and the expansion test of low precision. This low precision is due to the smallness of the sample (50 mm.,) involved and the tendency to crack under rapid heating (1600 °C in 90 minutes). We have found it to be impossible to secure satisfactory expansion tests on silica brick where they are heated to 1400–1500 °C in 6 hours because of their tendency to fracture under rapid heating. This criticism is removed however, when the test specimens are heated more slowly as at the Semet-Solway Co. laboratory.

During the discussion, values of 2.33 and 2.34 were mentioned as representative for the specific gravity of well burned silica brick. While picked samples may have these or even lower values the run of kiln will be denser.

DISCUSSION ON "THE INFLUENCE OF GRIND AND BURN ON THE CHARACTERISTICS OF SILICA BRICK"[1]

F. A. Harvey:—There is one point, that of methods for determining the effect of fineness of grind on the modulus of rupture, which is very important. In the open hearth, the problem of spalling seems to be one of importance. Coarsely ground brick work better in open hearth furnace than do finely ground brick.

R. M. Howe:—When this particular study was started there was considerable talk about basing a specification for silica brick upon the modulus of rupture. Consequently we were very anxious to learn to what extent this property was controlled by the present method of grinding and burning. It developed that the time of grinding was of very little influence although the temperature of burning was extremely important. The fact that spalling is a very important problem was not overlooked but was simply omitted in this particular study.

[1] This is a discussion of the paper by R. M. Howe and W. R. Kerr, *Jour. Amer. Ceram. Soc.*, **5**, 164 (1922). Discussion before the Refractories Division, 1922 Convention, St. Louis.

Mr. J. S. McDowell:—In connection with silica brick in open hearths it seems there are other characteristics than spalling which affect their life. For example, in the basic open hearth we find that the life of the roof-brick will vary from 200 to 300 heats—probably an average of 250. In acid open hearths, brick of the same brand will last from 1000 to 1500 heats. This strongly suggests that the action of some furnace products has an effect upon subsequent spalling after the brick has been in use for some time.

Mr. Greaves-Walker:—In line with what Mr. McDowell just stated in regard to the characteristics of silica refractories in roof work, I wish to relate conversation had with the president of a steel foundry company a few days ago. He is operating six ton electric furnaces. They were running basic up to a year ago and were getting the average number of heats from their roofs; then they changed to acid. He told me that under acid conditions he was having absolutely no trouble at all. I think this shows undoubtedly that the volatilized lime from the slag in the basic practice has a great deal to do with the destruction of silica roofs.

Mr. McDowell:—I really doubt that the study of the spalling characteristics of silica bricks will give a great deal of indication of the service of the roof for the reason that after a brick has been in service a short while it is not the same brick. A number of studies have been made which show the changes which take place in the composition of roof brick while in service. I believe Dr. Endell has collected some data on the subject and a very good paper has been published by Rengade in France. It appears that considerable lime and ferric and ferrous oxide are absorbed, so that silica brick, exposed to furnace gases, instead of having a silica content of approximately 96 per cent, after having been in use for a while, may have a silica content under 90 per cent on the end exposed to the heat. Naturally the spalling characteristics of such a brick would be altogether different from those of an unused brick.

Mr. W. A. Hull:—This may not be new, but in connection with what Mr. Howe was saying about hard burned brick not standing up against spalling as well as light burned, I might add that when Professor Fearnside of Sheffield University, England, was at the Bureau of Standards recently, I asked him what they did in England in the way of making repairs upon open hearth furnaces. He stated that they used very light-burned brick, they having given the best results and the least spalling.

Dr. Harvey:—I want to add one thing to what Mr. Howe said about this test on spalling. I do not think the results could be held as establishing the fact that you have the least spalling in service with an underburned brick. We were trying to determine a method of testing resistance to spalling. The Carnegie Steel Company have a method which they recommend for testing spalling of silica brick in a furnace temperature of

540°C. They heat the brick for an hour and then plunge into cold water. Now the most rapid expansion in silica brick occurs between the temperature of cold water and 540°C. In this spalling test the brick are heated back and forth through this expansion range, which is something that does not happen in actual practice.

In actual practice, I do not believe we have anything which shows that under-burned silica brick, or light burned silica brick, stand better than the hard-burned brick. This test shows, and the results show, as far as the test is concerned, that under-burned brick will stand the test better than hard-burned brick, but I do not believe it necessarily follows that that would be true in actual practice.

MR. HOWE:—These results justify the practice of using different grinds for the nine inch and shape mud, for the strengh of the finished products will be similar. The fact that two widely different grinds are used interchangeably also tends to substantiate the results of this investigation. These statements assume, however, that the grind is the only variable involved.

MR. MCDOWELL:—In connection with Mr. Howe's remarks, I believe there is a certain amount of evidence that in certain operations an under-burned brick shows less spalling than a well-burned one. Le Chatelier seems to have observed something of that kind for in one of his papers he says, in effect, that a light-burned silica brick is mediocre, a hard-burned brick is good, but a medium burned silica brick is detestable.

MR. GREAVES-WALKER:—Is it not true that to make a better silica brick we have been attempting to get 100 per cent tridymite-cristobalite content, which would mean a hard, dense brick, possibly the densest silica brick we can make, in order to make it stand up longer under thermal shocks?

MR. HOWE:—There has been a decided tendency to burn harder and the results obtained in practice seem to justify the extra expense when the brick are exposed in service to the highest temperatures. At lower temperatures, however, hard burning is of no advantage and may sometimes be a disadvantage. These conditions are proven by the fact that hard burned silica brick give very good service in open hearth roofs and coke-ovens when compared with those which are light burned. On the other hand light burned sand rock brick give extremely good service in furnace roofs where lower temperatures are involved. Thus the problem of spalling is by no means simple and the success or failure of a given type of silica brick will depend entirely upon conditions.

MR. MCDOWELL:—The present tendency to burn silica brick at high temperature has come about from the desire to eliminate, so far as possible, the residual expansion and was not based on the effect upon spalling.

MR. GREAVES-WALKER:—I think that was also taken into consideration. If you get increased inversion, you would reduce spalling.

MR. MCDOWELL:—I do not believe that has been done commercially.

MR. GREAVES-WALKER:—Dr. Endell, what is the German experience with silica brick, so far as spalling is concerned, between the light burned, medium burned and hard burned brick?

DR. ENDELL:—In our own steel plants we have only hard burned brick, burned in the same manner as burned here; and, as far as I know, they are using only hard burned silica brick for open hearth furnaces.

MR. GREAVES-WALKER:—Do you notice any difference between the hard brick and the soft brick, so far as spalling is concerned, and the resistance to thermal shocks?

DR. ENDELL:—I have not made a special investigation of spalling but I believe the spalling of silica brick depends on the amount of quartz, and this depends upon the burning temperature.

MR. MCDOWELL:—The light burned brick, such as we have been speaking of, would contain considerable quartz and not a great deal of cristobalite. It is probable that, so far as spalling is concerned, cristobalite is more harmful than quartz. I believe the thermal expansion curves of the two minerals would bring one to this conclusion.

FIRE CLAYS OF IOWA

NOTE BY PAUL E. COX

Milton F. Beecher[1] has made the only investigation on Iowa fire clays. Mr. Beecher did not find any fire clays in Iowa worth exploiting. Iowa has coal measure clays, many of them having been used in stoneware manufacture. The clay at Sargeant's Bluff in the western part of the state is the most refractory but it is not a refractory clay.

There is no reason to believe that Iowa will produce refractories.

DISCUSSION[1] ON "DATA ON OPERATION OF A CONTINUOUS TUNNEL KILN AT THE PLANT OF THE A. C. SPARK PLUG COMPANY, FLINT, MICH."[2]

MR. STAUDT:—I have had considerable experience with kilns, including a tunnel kiln which was not satisfactory and had to be torn down.

My experience with the tunnel kiln cost me good money, but I do not regret it as it proved to me that it is necessary to have a small tunnel kiln for small ware that requires very accurate firing both as to color and size. Such a kiln may not be so efficient so far as fuel economy goes, but it does

[1] *Trans. Amer. Ceram. Soc.*, Vol. XVII, 102 (1915).

[1] Whitewares Division, St. Louis Meeting, Feb. 28, 1922.

[2] McDowell and Helser, *Jour. Amer. Ceram. Soc.*, **5**, 267 (1922).

the work and saves in the quantity rejected. It is my opinion that you should have a big kiln for big ware and a small kiln for small ware.

MR. GOODWIN:—How do they determine the heat, when passing through the different zones, with cones?

MR. MCDOWELL:—The cones on any of the cars may be seen at any time from the open entrance to the tunnel. The fireman, knowing at what position in the hot zone he can expect the maximum heat, can, therefore, use the cones as a close check on the pyrometer.

MR. SCHRAMM:—Was the temperature gradient along the length of the kiln determined with a long thermocouple?

MR. MCDOWELL:—Yes. The temperature was read from a thermocouple extending up thru the bottom of a car to the level of the ware. This couple was attached to the pyrometer all during its travel thru the kiln, and readings were taken every foot of length.

MR. KLEIN:—Have you any way of measuring the temperature of the arch in the hot zone?

MR. MCDOWELL:—None except our pyrometer readings. The thermocouples extend through the arch and into the kiln six inches. These thermocouples show a temperature of 1440°C.

Mr. KLEIN:—Has the arch ever been replaced?

MR. MCDOWELL:—The arch has never been touched.

MR. SCHRAMM:—The good results reported by the authors, and especially their success in firing without saggers, are to be attributed chiefly to close control over firing conditions. The earliest work on surface combustion was done in this country by Professor C. E. Lucke; later, Bone, in England, independently developed furnaces working on this principle. For a time there was considerable speculation as to the nature of the process. In an early type of furnace, the mixture of gas and air under pressure was fed into a bed of granular refractory material within which combustion took place. Unusual results were obtained in the way of attaining high temperatures with a minimum consumption of gas. Among the factors contributing to this were:

1. Thorough mixing of the gases in passing through the bed.
2. Acceleration of combustion, due to contact between gas and solid.
3. The storing up of heat in the refractory bed and its emission in radiant form.
4. The "baffling" action of the refractory which permitted the gas-air mixture to be fed under considerable pressure without blowing out.

The net effect of these conditions was to permit complete combustion without excess of air, giving high efficiency, and to increase the amount of gas that could be burned in a given combustion space, promoting high temperatures. In the commercial application of these principles it has been found necessary in many cases to abandon the use of the refractory

bed, and to that extent to return to ordinary methods of firing, in which surface action is by no means absent. However, it would seem that so long as it is possible to achieve complete combustion of a theoretical mixture of gas and air, the chief advantage of the new system has been retained.

MR. A. W. BUCKINGHAM:—Two features of this kiln illustrate a tendency in present day kiln construction which make for better control:

First, the cross section of the kiln is as small as possible, consistent with the production required.

Second, the large number of burners in the firing zone undoubtedly permits considerable flexibility in "soaking" time.

Several points have occurred in reading over this paper which we believe the authors should have brought out:

What is the approximate cost of the different kilns?

MR. P. D. HELSER:—Due to the fact that both kilns were built during a period of high prices, the replacement cost at the present time can only be approximated.

The approximate replacement cost of the smaller kiln would be $10,000, while the corresponding figure for the larger kiln would be $20,000.

MR. A. W. BUCKINGHAM:—It is natural to suppose that heating up and cooling down a tunnel kiln would cause more or less wear and tear on the structure. The authors state that after two years of operation there has been very little damage to the kiln on account of this intermittent operation. To what particular features of the construction or operation do they attribute this?

MR. P. D. HELSER:—Small size, simple construction, and the nature of the refractory materials used in construction, are the factors which account in large measure for the slight damage.

MR. A. W. BUCKINGHAM:—The width of the kiln is given in the paper but not the height of the crown of the arch above the deck of the kiln car. It would be interesting to know how much space there is above the material being fired.

MR. P. D. HELSER:—This must necessarily depend upon the nature of the fuel and the difference in volume of the resulting combustion products.

MR. A. W. BUCKINGHAM:—Drop arches in the preheating zone should serve as effective baffles provided they extend down fairly close to the deck of the kiln car. How much below the crown of the main arch do these baffles extend?

MR. P. D. HELSER:—This depends upon the nature of the ware fired and its ability to withstand rapid preheating.

MR. A. W. BUCKINGHAM:—Manufacturers of this grade of ware would be interested in learning what the unit fuel consumption is, that is, cubic feet of gas per ton of ware, etc.

Mr. P. D. Helser:—The only ware burned in these kilns in quantities has been spark plug porcelain insulators. On this account figures on no other types of ware are available, and a comparison on a tonnage basis would obviously be meaningless.

Mr. A. W. Buckingham:—The method of taking temperatures for the full length of the kiln at twelve minute periods is a novel one and certainly should be very accurate. Do the authors suggest this as being a practical method of taking temperatures at frequent intervals throughout the day?

Mr. P. D. Helser:—Yes, it serves as a very satisfactory check.

Mr. A. W. Buckingham:—The second installation is described as being about twice the width of the smaller one. What is the total burning time in the longer kiln as compared to the twelve hours for the first installation?

Mr. P. D. Helser:—The total burning time is the same in both kilns.

Prof. C. B. Harrop:—For the firing of a shallow layer of small size ware, made from a body mix that will stand rapid heating and cooling, the above described kiln is undoubtedly a real success. However, for capacities such as are being secured from some of the other tunnel kilns firing sanitary ware, general ware and electric porcelain, this type of kiln would be entirely out of the question.

The Surface Combustion firing equipment is probably responsible to a large extent for the success of the kiln. Any other system of fuel application would undoubtedly result in so much greater volume of combustion gases that the temperature at the charging end of the kiln would be excessive and serious damage would occur to the entering ware. The Surface Combustion principle of firing gives an intense temperature in a restricted space which is absolutely necessary in a kiln of this length.

If the authors had given more real operating data, their paper would be of far greater practical value. It would be very interesting to know:

(a) Tonnage or number of pieces fired per 24 hours.
(b) Cubic feet of gas required per 24 hours.
(c) Total power required to operate the kiln.
(d) Labor required to operate the kiln.
(e) Cost of repairs—average over a long period.
(f) Approximate total cost of kiln.

Mr. P. D. Helser:—This kiln was designed for the purpose of burning one special type of ware to a comparatively high temperature. The kiln has given entire satisfaction for the purpose intended, and no extensive investigations on the firing of different types of ware have been made.

The kiln was designed and built to meet our special need, with no idea of further exploitation, therefore nothing was to be gained by giving it undue publicity.

While the Surface Combustion firing equipment is considered a successful accessory to the operation of the kiln, any efficient premixing device

delivering a correctly proportioned mixture of air and high-flame-temperature fuel would answer the purpose.

In fact, on account of the varying quality of the gas this Surface Combustion equipment requires constant adjustment to maintain correct combustion conditions and to give a desirable kiln atmosphere which is so essential to insure satisfactory burning conditions in any firing process.

Measurements as made on the larger kiln show a power consumption of fifteen H. P., which includes one H. P. for the pushing mechanism, four H. P. for the cooling fan, and ten H. P. for the operation of the blower furnishing the air for combustion.

The labor required to operate the larger kiln is one man full time, and an additional man one-half time.

The only data available on maintenance cost is that on the smaller kiln which was in operation for over two years. This cost approximated $200.00.

By C. C. Treischel:—The kiln described is a remarkable innovation in kiln building but I believe that its field is very limited, due to the fact that porcelains fired in it must be small and capable of absorbing heat very rapidly. Furthermore, I believe that a multiplicity of designs and sizes, such as is met with in practically every line of whitewares manufacture, excepting spark plug porcelains, would lead to difficulty because of continual readjustment of the control mechanism to meet operating conditions.

There is also some doubt in my mind regarding the relative degree of maturity of the top of the ware and the bottom, that is, in this case the tip of the spark plug porcelain in the one case and the top or large end in the other. It seems to me that the tip being more exposed to the reflected heat in the kiln would be matured more than the larger end which is against the bottom of the tray. This might not be a disadvantage in spark plug porcelains but would be in the case of most designs used in the whitewares industry.

However, the builders of this kiln must be congratulated because they have evidently solved their individual firing problem, which is more than most of us can say for ourselves.

DISCUSSION "THE FIELD OF PORCELAIN GLAZES MATURING BETWEEN CONES 17¾ AND 20"[1]

By H. H. Sortwell:—Mr. Twells' work was admirably chosen in that it filled a vacancy so that now from the work of Stull, Stull and Howat, the writer, and Mr. Twells closely agreeing data are available on this type

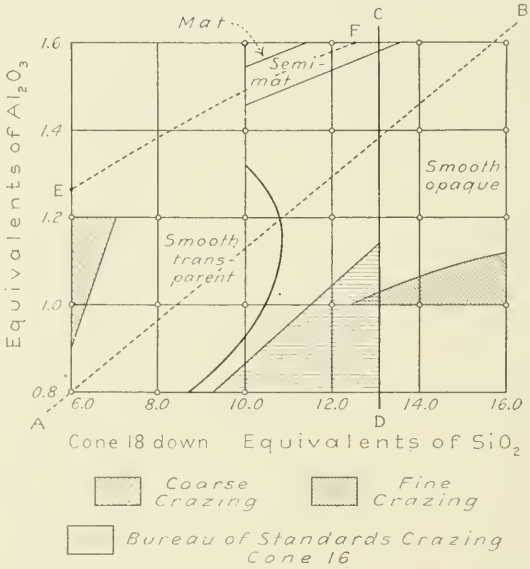
[1] *Jour. Amer. Ceram. Soc.*, **5**, 430 (1922).

of glaze covering the wide range in temperature of from cone 9 to cone 20.

Considering the difference in materials, methods, and medium of firing the agreement of the results from cone $17^3/_4$ to cone 20 with those obtained at the Bureau of Standards is surprisingly close.

Below is reproduced Mr. Twells' Fig. 5 representing his results at cone 18, with the results of the writer in that portion of the field at cone 16 superimposed thereon for comparison.

The dotted line AB which practically bisects Mr. Twells' field shows the location of the glazes designated by the formula $Al_2O_3 = 0.3$ plus $^1/_{12}$



Twells' Fig. 5

AB – $Al_2O_3 = 0.3$ plus $\frac{1}{12}$ SiO_2
CD – Upper limit in SiO content of Bureau of Standards glazes.
EF – Limit of area of bright glazes at cone 16.

SiO_2 which was derived from the results obtained at the Bureau of Standards and was given as the axis along which the best glazes lie. The line CD indicates the upper limit in silica content of the field of glazes studied at the Bureau, the dotted line EF shows the limit of the area of bright glazes at cone 16, and the horizontal hatching denotes the crazing which occurred at the same temperature. The agreement is evident.

The recession in the crazing area is about what would be expected had the trials been the same in both cases. The coarse mesh crazing noted by Mr. Twells is evidently the type of crazing referred to by the writer as crazing caused by overfiring. It was to be expected that the failure of some

of the high flint glazes to lie down to smooth surfaces reported by the writer, would not occur in the field studied by Mr. Twells. The glazes in which this appeared were very much lower in alumina and were the only glazes in the Bureau of Standards compositions which contained more than 55 per cent flint excepting one of higher alumina content.

Bureau of Standards

DISCUSSION ON "COMPARATIVE TESTS OF AMERICAN AND FOREIGN TABLEWARE"[1]

By H. F. Staley:—Mr. Sortwell has done a very nice piece of work in devising and applying comparative tests to American and foreign tableware. It is very pleasing to learn that American wares show up so well in the various tests in comparison with the foreign makes. This is only one more proof that the manufacturers of ceramic products in this country need not fear public tests of their wares in comparison with those of foreign makes. In every case where a certain quality of ware has been demanded, the American tableware manufacturers have been able to produce it. If comparative tests of any other ceramic product should show that the American material is inferior to the foreign material, we can rest assured that the American ceramic manufacturers have sufficient ability and ingenuity to speedily correct the defect. In other words, the ceramic industries in this country will have nothing to fear from publicity and have much to gain.

AN ACCOUNT OF AN INVESTIGATION OF SOME GEORGIA CLAYS AND BAUXITES[1]

By R. B. Gilmore and A. H. Fessler[2]

Introduction

Through the central part of Georgia, and traversed by the Central of Georgia Railway Company's lines, lies a belt known as the coastal plain containing large deposits of clays and bauxites. Besides this a small area occurs in the northwestern part of the State. These deposits vary from typical kaolins on the one hand to high grade bauxites on the other. The belt is two hundred and twenty-five miles long and varies from twenty to fifty miles in width. They are for the most part surface deposits with very little or no overburden, attaining a thickness in some places of forty feet. Deposits of from four feet to twenty feet are common. The fields have been worked to some extent but never have been developed for the ceramic

[1] Sortwell, *Jour. Amer. Ceram. Soc.*, **5**, 276 (1922).

[1] Published with the permission of the Director of the U. S. Bureau of Mines.

[2] Received July 18, 1922.

trade to the degree to which they are worthy. The railway company realizing this fact, and the great potential wealth of the deposits, is carrying on an extensive investigation of these clays and bauxites through a coöperative agreement with the U. S. Bureau of Mines. The Bureau in turn is coöperating with ceramic industries for making large scale practical tests to confirm the laboratory findings.

The work has been in progress over a year and will be continued to completion. The tests are made on a semi-commercial scale in order to obtain practical data on the value of these materials for commercial purposes. Two ton samples from each of twenty-four of the most typical deposits were sent to the Ceramic Experiment Station at Columbus, Ohio, where tests are being made. The final phase of the investigation will be to put these clays through the commercial practices for which they appear to be best suited as indicated by preliminary laboratory tests.

The clays, roughly classified into two types, are included in the investigation, namely, those suitable for pottery and allied products and those suitable for refractories. The main investigation on the white burning clays consists of developing improved refining methods with the objects in view of eliminating undesirable impurities and producing a more uniform product. In the refractory work, both small and large scale tests are made to determine the behavior of the raw materials under manufacturing practice and the serviceability tests are to be made under actual furnace conditions.

Preliminary Tests

Preliminary tests were first made on the samples to determine the physical properties of these materials in order to indicate the purposes for which they were best suited. The tests included shrinkage, both drying and burning, porosity, burned color and fusion temperature on raw material together with viscosity determinations on the slips. The viscosity tests were made to determine the proper amount of caustic soda to be used in the washing so that the most efficient separation of impurities might be obtained.

Refining Study

Besides a blunger, agitator, filter press, and other auxiliary machinery commonly used for preparing the slip and collecting the washed clay, the clay washing apparatus consists of two elutriating cans and a "whirlpool" clay separator built according to design of Mr. R. T. Stull, Supervising Ceramist of the U. S. Bureau of Mines. This separator is in effect an elutriator in which the slip enters tangentially and near the top instead of through a pipe down the center to near the bottom. A whirlpool action is caused which throws the coarser particles toward the center and down, where they are collected in a container attached to the bottom of the can.

TENN.
N. C A R.
S. C A R.
ALABAMA
GEORGIA
CHATTANOOGA
Ft Oglethorpe
Chickamauga
Lafayette
Dalton
Rome
Cedartown
ATLANTA
ATHENS
AUGUSTA
Porterdale
Raymond
Griffin
Stevens Pottery
Milledgeville
Barnesville
Greenville
Thomaston
MACON
Gordon
McIntyre
Millen
Dover
COLUMBUS
Butler
Fort Valley
Toomsboro
Perry
Dublin
Americus
SAVANNAH
Springdale
Cuthbert
Ft Gaines
ALBANY
Central of Georgia Ry
CLAY (KAOLIN)
AND
BAUXITE BELT
OF
GEORGIA
SCALE

FIG. 1.

A paper in the *Journal*, giving in detail a description and principles of operation of this separator, will be published later. The elutriating cans are large, each being four feet high, one is three feet and the other five feet in diameter. The capacities are one hundred and sixty-five and four hundred and fifty gallons, respectively. The arrangement is such that the slip after passing through the screens is then passed through the separator, then through the elutriating cans and finally the overflow from the larger can is caught in a seven hundred and fifty gallon settling tank.

A thousand pounds of clay are blunged at which time caustic soda is added to accomplish deflocculation and when blunging is completed the slip is passed through a nest of standard screens, Nos. 8, 20, 65, 100 and 150. It is then pumped into an agitator overhead and run through the washing system, a constant head being maintained to assure a constant rate of flow.

There are five separations derived in this operation after the clay slip has passed the 150 screen. The majority of the impurities are contained in the first one, or the residue in the grit collector of the "whirlpool" separator, while the separate, or material deposited in the settling tank, is in most cases practically free from impurities, consisting almost entirely of kaolinite. The apparatus has produced very favorable results and unless the impurities are in an extremely finely divided state they may be removed, producing a clay which burns to almost a snow white color and free from small objectionable specks. A slight trace of very fine quartz grains in some cases was the only foreign material found in the washed product, when examined under the microscope. The "whirlpool" separator, besides removing the fine grit, also removes the thin mica flakes which are not eliminated under present clay-washing practice. The recovery of valuable clay is also higher.

Such pleasing results have been obtained in some of the samples washed that several hundred pounds of the refined material have been sent to manufacturers making various kinds of white ware in order to test the pottery-making properties of these refined clays in a practical way. The clay will be put through actual commercial practice in the manufacture of pottery, wall and floor tile and electrical porcelain. In this way the working, drying and burning properties may be ascertained in the plastic, dry press and semi-dry press process. This phase of the work is to be of such an extensive nature that complete data on the clays tested may be available for users of white clays.

After the washing investigation has been completed at the Ceramic Station, it is planned to remove the washer to some point in Georgia and continue the work on a practical basis. Work will also be done, either at the Station or in Georgia after the washer has been set up there, on the dewatering of clay slips by methods other than filter pressing. Several

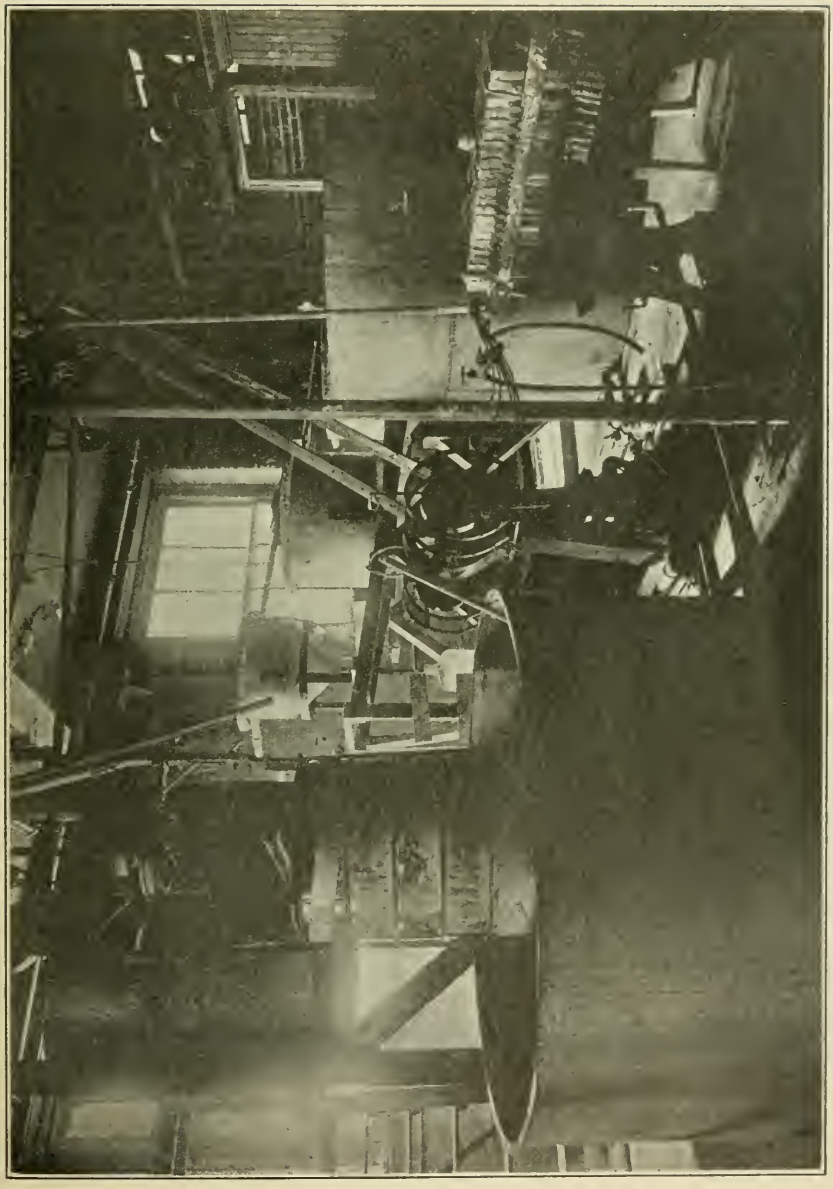


FIG. 2.

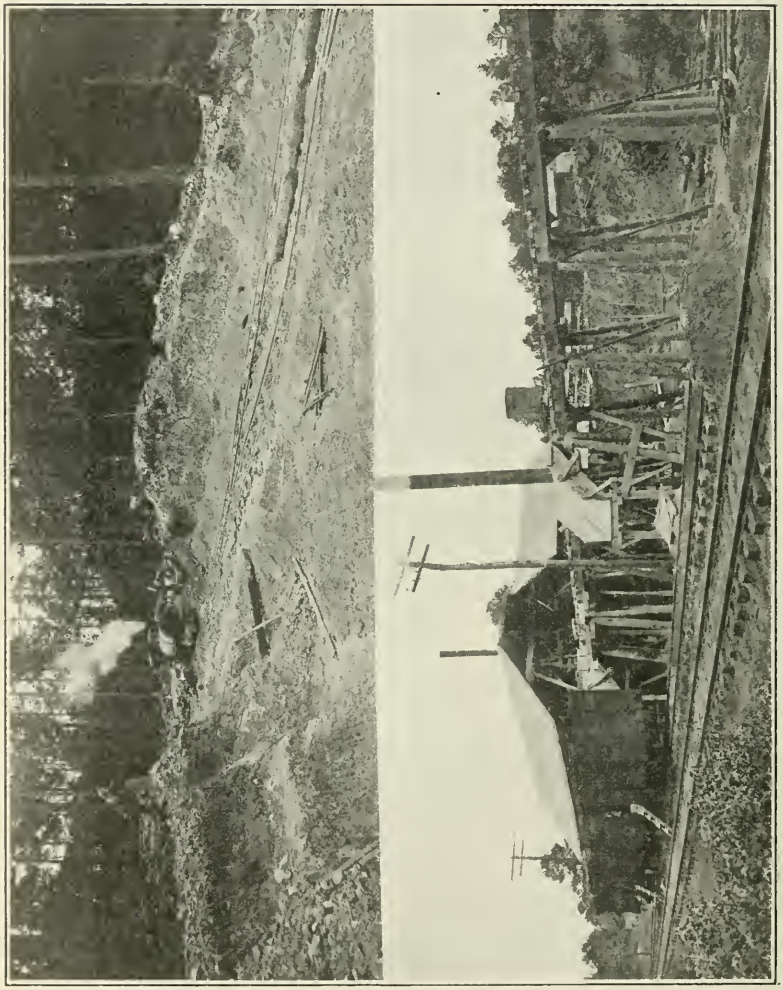


FIG. 3.—General Bauxite Co., Nadine, Ga.

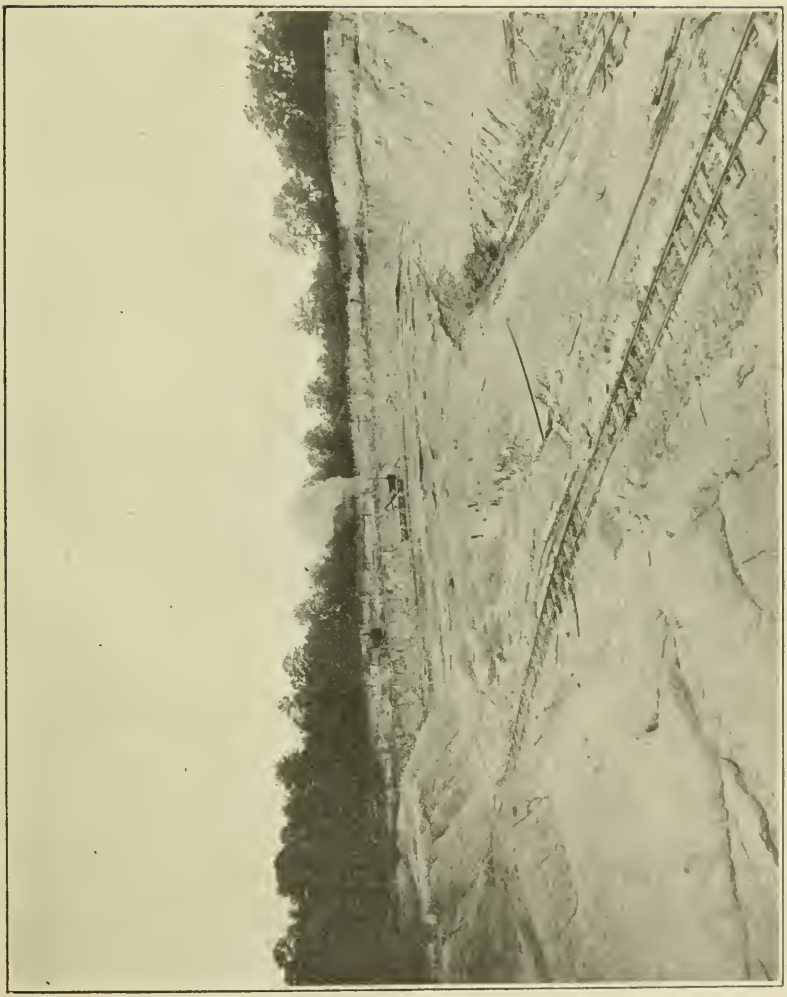


FIG. 4—Edgar Bros. Co., McIntire, Ga.

work was suggested on account of the fact that filter pressing is comparatively expensive and in exceptional cases appears to render the clay unsuitable for certain purposes.

Refractory Study

Although the refractory study has only been started, sufficient work has been done to determine which clays are particularly valuable for refractory purposes. The laboratory work, thus far, in this connection has been confined largely to fusion, spalling and load tests.

The samples chosen for this study were divided into three classes, those properly classed as (1) clays or kaolins, (2) bauxitic clays, and (3) bauxites. Besides the bauxites, nine clays and five bauxitic clays seemed worthy of investigation for refractory purposes. To supply the grog for the refractories made from clays (Class 1), samples of these clays were calcined to cone 14 and ground to pass a No. 10 mesh screen. Sixty per cent of each grog thus prepared was mixed with forty per cent of the same raw clay to serve as the bond. Bricks of the standard size were made of these mixtures by the dry press process and burned to cone 14. The porosities were determined on the whole brick by the gas expansion porosimeter and the bricks subjected to the standard spalling test. Ten quenchings were made and the loss in weight taken as an indication of the resistance to sudden temperature changes.

Load tests at furnace temperature were also made on some of the fire-brick which indicated remarkable resistance to spalling. Some phenomenal results were obtained in the load tests and in two cases especially the results of the spalling tests were far above the average fire brick, the spalling loss being less than 0.60 per cent. In the fusion tests not one of the samples gave a fusion temperature below cone 34, approximately 1740° C or 3164° F.

The samples of bauxites and bauxitic clays were made into bricks in the same manner except that the grog samples were calcined to cone 17. Because the raw materials were low in plasticity and bonding strength, one of the clays of good plasticity which had given high scores in the fusion, load and spalling tests was selected as the bond. Seventy per cent of the calcined material was mixed with thirty per cent of the bonding clay molded dry press and burned to cone 16.

The clays which showed exceptionally good results in these tests will be tested in a practical way on a much larger scale. A carload of one of the most promising clays has been shipped to a well known fire-brick plant where it is to be made up into standard refractories. Arrangements have already been made to test these refractories for locomotive arches, malleable iron furnace bungs and electric furnace linings. A sample of bauxite

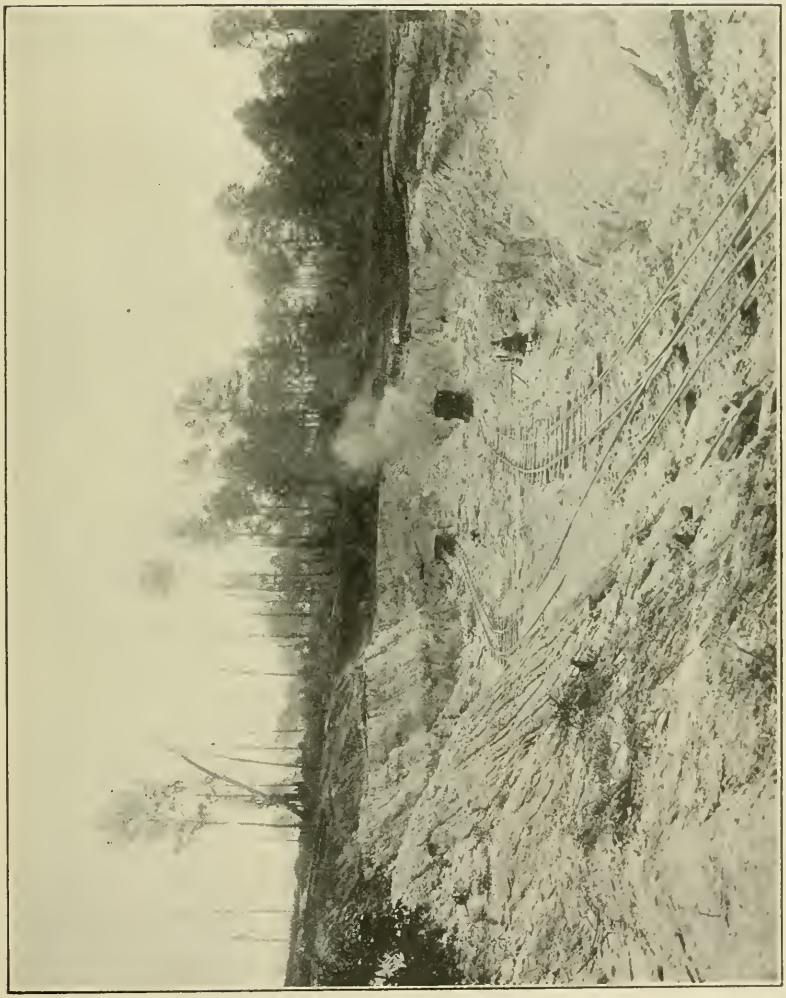


FIG. 5—Savannah Kaolin Co., Gordon, Ga.

has been sent to the Bureau of Mines Experiment Station at Seattle, Wash., where it is to be sintered, made into refractories and tested as a lining in an electrically heated high temperature metallurgical furnace. Although the work at present time has not been completed, enough has been done to indicate the ceramic possibilities of this extensive belt of clays and bauxites.

COLUMBUS, OHIO.

ACTIVITIES OF THE SOCIETY

Increase in Membership Support

Twenty personals and five corporations is the gross score for August. There has been the normal loss (1 associate) this month. The net increase in members for the first seven months of this calendar year is:

	Personals	Corporations	Total
August 10, 1922	1509	188	1697
January 1, 1922	1350	139	1489
Net Increase	159	49	208

The membership status and gains for the past five years are here shown:

	Record		Increase	
	Personal	Corporation	Personal	Corporation
February 1917	537	None		
February 1918	717	33	180	33
February 1919	911	73	194	40
February 1920	1133	94	222	21
February 1921	1243	105	110	11
January 1922	1350	139	107	34
At Present Time	1509	188	159	49
		Total	982	188

It is remarkable that in the years preceding the present, practically all of the additional membership support was secured during the later months of the year. This year there has been a steady net increase, in fact the membership has steadily increased since the Society has had a full time secretary, not directly because of his activities but because of the larger service which the Divisions and standing committees have rendered.

The gross increases in membership by periods since June last year are:

	Personals	Corporations	Total
1921 June to September	41	11	52
Sept. to December	18	2	20
Dec. to February, 1922	136	21	157
1922 Feb. to May	81	10	91
During May	13	13	26
June	13	5	18
July	25	11	36
August	20	5	25
Gross Totals	347	78	425
Loss	81	5	86
Net increase	266	73	339

The average monthly gross addition from June to June was a little better than 25 personals and 5 corporations. During the past summer months there was a falling off

in the "batting average" of the team as a whole notwithstanding the large scores made by A. F. Hottinger, B. E. Salisbury, O. O. Bowman, 2nd and C. E. Bales.

The team is now getting into its winning stride; things are getting back to normalcy. If history will repeat, and it always does with those who are in earnest, our present team of 1697 members will from now on run up a much larger average each month. Our team has always played better and more consistent in the fall and winter months; indeed with increasing monthly averages.

A statistician would figure from the "laws of averages" in our case, that a reasonable expectancy would be a net increase of 200 personal and 100 corporation members during the next three months. This would be based largely on the more general coöperation now being shown by the individual members, and by the more active and efficient Division organizations.

A. F. Hottinger

B. E. Salisbury

The following shows the hitters, and the scores made by each, during the months of July–August.

		Personal	Corporation
R. R. Danielson; P. D. Merica; W. S. Williams; W. M. Clark; W. A. Hull; H. H. Sortwell; J. W. Cruikshank; D. H. Fuller; R. F. Segsworth; August Staudt:	1 each	10	..
C. E. Bales; G. R. Truman	2 each	4	..
Mrs. Arthur F. Weaver		3	..
O. O. Bowman, 2nd		1	2
A. S. Zopfi		..	2
Secretary's Office		2	1
		20	5

The Society is now doing more real constructive work than at any time in the past; the Industrial Divisions and the committees are functioning, not 100%, but consider-

ably more than at any time heretofore. We can continue with the larger and more interesting *Journal* if the members secure the required financial support.

The business of the Society is being handled as economically as is consistent with making progress. The Board of Trustees has proceeded on the policy of making an article for which there is a demand, then showing it, and in all legitimate ways promoting it.

The service rendered by the Society is measured by the *Journal* but it is not altogether the *Journal*. The original papers, the discussions and the abstracts published in the *Journal* are the records of results achieved. The prime service of the Society, making the *Journal* possible is the research promotion and education, decentralized through the several Industrial Divisions, but on a coördinating program.

The Society at the present time is solvent with $12,402 cash (or Liberty Bonds) and $4,098 account receivable. These figures do not include inventories of Transactions, Journals and other publications nor of office equipment. It is not that the Society is financially embarrassed at the present time that new members are required but it is that the expenses are exceeding the income and hence, if the Society is to continue the service it is now rendering, more members will have to be secured.

Even if the income did equal the expenses there would be the same need for vigorous solicitation of additional support, for as the Society continues to serve, the demands and the opportunities for service will increase.

There is no human enterprise, no matter how unselfish and beneficial it is, that does not have to be promoted vigorously if it is to succeed. No Chamber of Commerce, no business man's club, no church or school, and certainly no technical Society can be maintained without continued selling of it to prospective supporters. Our task, therefore, is not for this Fall alone, but for as long as the Society continues. Will each member realize the importance of succeeding with this task that the Society may continue to meet the ever-increasing demand for the peculiar research promotional and educational service for which it is organized?

One hundred and eighty-eight ceramic corporations are now subscribing an annual fee of $25 to the support of the American Ceramic Society that the personal membership may be kept within the financial possibilities of the young men in the plants for whom the educational enterprises of the Society are especially directed. This Society is unique in that the personal subscription has been kept at the low figure of seven dollars and a half. Over 1500 persons are now having the privileges of membership at this low annual fee because of the larger subscriptions paid by corporations by whom the benefits are more largely realized.

Application to industrial problems of results of researches in the fundamental sciences, and of the engineering and technical investigations; surveys of material resources, and processes; standardizing of tests; writing of specifications for materials and products; finding of the most effective process controls; these are the tasks of the ceramic research laboratories. It is such activities as these that the American Ceramic Society promotes and coördinates. This is the modern method of pyramiding scientific facts and theories into industrial processes and products, and at no time more than at present were organized coördinating and promoting services so sorely needed by the ceramic industries. There is an increasing industrial requirement for research work; the federal, state and collegiate organizations are responding; the trade associations are financing; the American Ceramic Society must furnish the clearing house facilities that the work of each of these agencies may be correlated to the largest possible economic advantage. This is why the Divisions and Committees are more active and why the *Journal* has been so largely increased; and, in consequence, these are the reasons for the goal of 200 personal and 100 corporation additional members.

New Members Received from July 13 to August 10

ASSOCIATE

Backus, (Mrs.) Lulu Scott, 451 So. Goodman St., Rochester, N. Y. Head Dept. Crafts, Mechanics Institute.

Branham, Ivan Bundy, 323 So. Chester Ave., Pasadena, Cal. Bachelder-Wilson Co., Los Angeles, Cal.

Harrington, Rufus F., 383 Dorchester Ave., So. Boston, Mass. Hunt-Spiller Manufacturing Corporation.

Hartshorn, Theodore D., Kensington, Md. Ceramic Division, U. S. Bureau of Standards.

Hebden, James B., 1415 Brook St., Louisville, Ky. Louisville Fire Brick Works.

Beggs, F. M., Tiffin, Ohio. United States Glass Works.

Keese, A. W., 16220 Saranac Road, Cleveland, Ohio. The Collinwood Shale Brick & Supply Co.

Kidder, C. Paul, Klondyke, Ohio. Patterson Foundry & Machinery Co.

Lathrop, John Sherman, 603 So. Louisa St., Glendale, Cal. Tropico Potteries.

Matson, J. Burnett, 705 S. Walnut St., West Chester, Pa. Mechanics Institute, Rochester, N. Y.

Merian, Frederic, 3415 Iowa Street, Pittsburgh, Pa. J. W. Cruikshank Eng. Co.

Mudge, William A., International Nickel Co., Huntington, W. Va.

Murray, John C., 66 Barrie St., Kingston, Ont.

Niece, Norman L., Box 348, Arnold, Pa. American Window Glass Company.

Pendergast, W. L., 1775 California St., Washington, D. C. U. S. Bureau of Standards.

Shegog, Thomas A., 167 West 130th St., New York City.

Spencer, Charles D., Nela Park, Cleveland, Ohio. National Lamp Works of G. E. Co.

Thayer, Florence E., 8 May St., Worcester, Mass. Supervisor of Drawing, Worcester, Mass.

Watkins, Jack H., Charlotte C. H., Virginia.

Woods, B. J., Dubuque, Iowa. U. S. Bureau of Standards.

CORPORATION

Baker Bros. Glass Co., Okmulgee, Okla. (W. G. Baker, Pres.)

Chicago Retort & Fire Brick Co., 208 So. LaSalle St., Chicago, Ill. (John H. Cavender, V. P.)

Golding-Keene Co., Keene, N. H. (Charles E. Golding.)

Thomas Maddock's Sons Co., Trenton, N. J. (C. S. Maddock, Jr.)

Sunflower Glass Co., Sapulpa, Okla. (Frank Bostock, Pres.)

Who's Where in the American Ceramic Society

James M. Bonner, formerly of the Zwermann Co., Robinson, may now be found at Abingdon, Ill.

Arthur L. Donnenwirth, who graduated from the Ceramic Dept., O. S. U., in June is now located at Kenova, W. Va., with the Jeffery-Dewitt Insulator Co.

Gerald Fitz-Gerald, formerly of the Maxon Furnace & Engineering Co. can be found at 20 Hockley Hills, Gem Building, Birmingham, England.

Herbert Forester, of the Veritas Firing System, Cleveland, Ohio, has moved to a suburban home on Bassett Road, Bay Village, Ohio.

G. W. Greenwood, who is secretary and a director of the United Refractories Co.,

is also Resident Manager of Curwin's Accountancy Co., Inc. with headquarters at Wilkesbarre, Pa.

Mokiji Ichijo, a graduate of O. S. U., can now be addressed in care of Japanese Consulate General, 165 Broadway, New York City.

F. A. Kirkpatrick, has left the Jeffery-Dewitt Insulator Co. of Kenova, W. Va. and is at present on a vacation in Unionville, Mich.

P. William Lee, formerly located at 395-14th Ave., Columbus, Ohio, is now at 3401 Race St., Denver, Colo.

E. H. Lintz, of the Jewett Refrigerator Co., Lackawanna, N. Y., is now living at 404 Baynes St., Buffalo, N. Y.

Paul Niegsch, of the Porcelain Enamel & Mfg. Co., is living at 2437 Parkwood Ave., Baltimore, Md.

James G. Phillips, formerly of the U. S. Bureau of Mines, Columbus, Ohio, can now be found at 515 Cottage Ave., Piqua, Ohio.

W. C. Stief, has been changed from The Floretine Pottery, Cambridge, Ohio, to The Mt. Clemens Pottery Co., Mt. Clemens, Mich.

William C. Snowden, has moved from Sheffield to Stockton-on-Tees, England.

Wlbur Stout, with the Ohio Geological Survey, formerly addressed R. F. D. 1 is now located at 154 Erie Road, Columbus, Ohio.

W. F. Wenning, of 3313 Allendale St., has changed to 3447 Allendale St., Pittsburgh, Pa.

H. G. Willetts, of the Willetts Company, has asked that his mail be sent to P. O. Box 1047, Pittsburgh, Pa.

Northern Ohio Section of American Ceramic Society
Minutes of the Fifteenth Meeting

The 15th meeting of the Section was held Tuesday, June 6, 1922, in the rooms of the Cleveland Engineering Society, Hotel Winton, Cleveland, Ohio, with an attendance of ten members. Various matters pertaining to the welfare of the Section were discussed informally before and during lunch, which was served at 1:00 P.M. The only matter acted on officially was the appointment of a representative on the Society's Nominating Committee, the Secretary being unanimously chosen.

The afternoon was devoted to an inspection of the canal road plant of the Cleveland Builders Supply and Brick Company, the trip being made by automobile. This plant is very modern and produces high-grade face brick from local shale. There are eleven rectangular, down-draft kilns, each holding about 150,000 brick, and the daily production is 55,000. Each kiln is 17 x 90 feet in size, and has 22 fire boxes, coal being the fuel used.

Mr. E. E. Roll, who has general supervision of the kilns at all the plants of the company, explained new improvements which he has devised in firing methods, resulting in a marked decrease in coal consumption. The Section is greatly indebted to him for his kind interest, also to Mr. J. F. McKay, plant superintendent, whose delightful hospitality added much to the success of the meeting.

A. F. Gorton, *Secretary.*

Third Conference of the International Union of Pure and Applied Chemistry

The third conference of the International Union of Pure and Applied Chemistry was held at Lyons, France, June 27 to July 2 under the presidency of Dr. Charles

Moureu. Twenty-three countries were represented at the meetings. America was represented by the following delegation, C. L. Parsons, E. W. Washburn, H. S. Washington, R. B. Moore, Edward Bartow, and W. D. Bancroft, members of the Council, and Messrs. W. A. Noyes, A. C. Langmuir, John Frazer, Atherton Seidell, and A. P. Matthews, members of the General Assembly. Three meetings of the Council and two meetings of the General Assembly were held. The sessions were interspersed with committee meetings, social events, scientific lectures and numerous excursions to factories in Lyons and vicinity. The visiting delegates and their ladies were royally entertained by the people of Lyons and the meeting was in every way successful and will be long remembered by all present.

At the final session of the General Assembly, Sir William Pope was elected President for the ensuing three year term and it was voted to hold the next meeting of the Union in the Summer of 1923 at Cambridge, England. After the adjournment of the Conference, the delegates were the guests of the Lyons Committee on a steamboat excursion down the Rhone to Avignon whence the delegates proceeded to Marseilles where they were the guests of the French Society of Industrial Chemistry at its annual meeting and where they had the opportunity of visiting the French Colonial Exposition.

The following committee reports which were adopted at Lyons are of especial interest to members of the American Ceramic Society.

Report of the Committee on National and International Fuel and Ceramic Research Laboratories

The committee made the following recommendations:

1. Each country belonging to the Union shall be invited to establish, through a committee or other suitable agency, a systematic nomenclature for fuels, and legal and commercial definitions of the various combustibles together with an exact description of their various properties, physical, chemical, physico-chemical and organoleptical.

2. Through the same agency each country shall also make a complete compilation of the methods and apparatus of research, analysis, and testing, which are employed in the country, either officially or commonly, to the end that this information may be available as a basis of discussion for formulating, ultimately, a set of standard definitions and methods which shall be internationally adopted.

3. In order to facilitate the exchange of information the Committee requests that the committee or other agency established in each country shall correspond directly with the President of the International Committee on Fuels.

Report of the Committee on an International Definition of the Term "CERAMIC"

The committee had before it an excellent French translation of the report of the American Ceramic Society's Committee on Definition of the Term "Ceramic." This report was printed and placed in the hands of all the delegates in attendance at Lyons. The committee approved unanimously the recommendations contained in this report and voted that it serve as the basis of discussion of the question which should be brought before the next meeting of the Union for final consideration, after each country belonging to the Union had had an opportunity to study the report and contribute to the discussion.

Report of the Committee on Chemical Periodicals

The following extracts from the Committee's report are of special interest:

1. All literature references should be given in terms of the abbreviations employed by Chemical Abstracts.

2. The official abbreviation of the word "Japanese" shall be "Japan."

3. All papers shall bear the address of the author or of the laboratory from which they originate.

4. All papers shall be accompanied by an abstract in one of the four languages English, French, German or Italian.

E. W. Washburn, *Delegate.*

Report of Research Committee, U. S. Potters Association

The Research Committee reported to the U. S. Potters Association on the progress of its work at the summer meeting held at the Stacy-Trent Hotel, Trenton, N. J., August 2nd.

The first report was made by Mr. Thomas B. Anderson on the use of forced draft burners, for the combustion of natural gas in bisque kilns. From the results obtained it seems that the use of low pressure air in this connection has proven successful from the standpoint of improved burning. More uniform firing is obtained and the heat can be driven to the center of the kiln without over-heating the first ring. Little if any gas is saved and the heat is harder on the kiln mouths and bottoms. There is also more radiation from the kiln walls. The uniformity of the ware and the satisfactory color obtained have justified the installation.

Mr. C. H. Walker reported upon the question of kiln dirt. He advised the use of mechanically stronger saggers, frequent lawning of the glaze, cleaning of the inside of the kiln crown, somewhat slower firing up and cooling, the use of non-flying clay in the wads and the elimination of the sliding of the saggers upon each other, as factors which tend to reduce losses due to kiln dirt. The results from a questionnaire indicated that the life of saggers is on the average from 10 to 13 firings.

Mr. S. B. Larkins reported that a mixture of pottery plaster and white Portland cement, in the proportion of 2 to 1 yields good pottery cases. He also described a satisfactory kiln damper.

Mr. John S. George submitted the results of a questionnaire on lawns and found that about an equal number of rotating and reciprocating lawns are used and that the average capacity of all lawns is approximately 285 pounds per hour, and per square foot. The potteries that use wire cloth employ the 110 or 120 mesh and those using silk lawn the meshes known as IIXX and 12XX.

Mr. F. K. Pence submitted a table in which tests are compiled for the differentiation of the various pottery materials.

Mr. Ira E. Sproat reported upon the properties of three promising clays for the pottery industry, a semi-ball clay from Missouri, a prepared clay from North Carolina and a kaolin-like clay from Tennessee, of considerable apparent value.

He also submitted the results obtained with the use of cobalt sulphate, precipitated with carbonate of soda, as a body stain. He found that a solution composed of 200 ounces of water, 5.5 oz. of cobalt sulphate and 3 oz. of carbonate of soda added to 3000 pounds of body gave the same tint as the regular stain. It was stated, however, that where 60 or more per cent of the water is used over again trouble will occur owing to the concentration of the sodium sulphate which interferes with the casting. It is advised to use only a portion of the water over again or to make up a separate casting body.

Mr. A. V. Bleininger discussed the importance of allowing for the water content of the different body materials and raised the question as to what should be considered a normal water content for each material since it is evident that none of the compositions usually given are based on the use of dry weights. He submitted results obtained at different plants.

The same speaker described also good casting practice and advocated the use of as heavy a slip as possible, with a gravity of 1.8 for the pipe system and 1.78 where

barrels are used. The proportion of soda ash to liquid silicate should be kept in the ratio of 1:2 and under no circumstances should the fluidity of a slip be increased by the addition of water, but only by the systematic addition of the alkaline materials.

The reports of Messrs. Larkins, George, Pence and Sproat were read by the chairman. The latter then submitted to the Association the plan of the AMERICAN CERAMIC SOCIETY to conduct a comprehensive research on saggers as outlined by Mr. Treischel at the St. Louis meeting of the Society. After some discussion the Research Committee was instructed to prepare a reply to the Secretary of the Ceramic Society and to recommend a course of action.

The chairman next discussed the tests of pottery adopted tentatively in conference with the Bureau of Standards and the additional work now being done on this subject in Washington. It was pointed out that such tests are not only of importance in classifying pottery but can be made to serve in plant practice in assisting to maintain constant quality and to test out the glaze fit.

The chairman emphasized the need of determining accurately all the physical properties of American pottery and the materials used, such as the heat expansion of body and glaze, the effect of glaze fit upon the mechancial strength, the resistance of the glazes to abrasion, etc., and it was suggested that the Association enter upon an investigational program along these lines in coöperation with the Bureau of Standards. The Association then voted an amount not exceeding $3000 for the inauguration of such a research at the above Bureau.

A. V. BLEININGER, *Chairman.*

We Thank You

"If we satisfy, you tell it to others; if we do not, please whisper it to us," is a well known pert advertising phrase.

We get many a whispered and sometimes a shouted criticism of what we have done that we ought not to have done, or have left undone that we ought to have done. A paragraph like the following, therefore, comes like a double mint ice cream soda with two straws, on an August day in central Ohio.

> "Enclosed you will find personal check payable to the Society for membership dues for the year 1922.
>
> Your kind letter July 31st received and I wish to thank you personally for sending me the June number of the *Journal.* I received many times the value of the membership in this one issue alone. I certainly wish that the back numbers and the coming issues be forwarded to my office address.
>
> Wishing you personally and the Society in general unlimited success and trusting you will have an enjoyable outing with your fellow workers this summer. It will be a glorious trip and one that I would certainly enjoy if it would be my good fortune to go."

Such a message refreshes us, makes us feel good all over, and enables us to go back to work with zest.

A Step toward Coöperation

Mr. Ross C. Purdy, General Secretary,
American Ceramic Society,
Columbus, Ohio.

My dear Sir:

I have delayed answering your letter of June 30 until I could get time to read over the pamphlets that accompanied your letter.

I am extremely interested in the subject matter of your letter and of the pamphlets, and particularly that which relates to coöperation of your Society with state geological surveys.

The North Carolina Geological and Economic Survey, through its geological and mining division, is taking up particularly investigations relating to clay, feldspar and quartz deposits of North Carolina. In connection with these investigations we have immediately realized the need of a ceramic laboratory. At the present time there is not, as far as I know, a fully equipped ceramic laboratory in the South; and as Director of the North Carolina Geological and Economic Survey, I am very anxious to arrange to have established here at the University of North Carolina, with which the Survey is associated, an up-to-date and complete ceramic laboratory which will enable us to thoroughly test our clays and feldspars; be able to test out all types of mixtures for pottery, tile, terra cotta, firebrick, and common brick, etc. There are many problems in connection with the clays of this State that need to be worked out, and I want to be in a position to work them out within the State. A ceramic testing laboratory, if erected at the University of North Carolina, could and probably would be used by nearly all the Southern States.

Dr. Ries of Cornell University has done considerable work for this Survey on the clays of North Carolina; as has also Mr. Watts of Columbus. We hope to have associated with us within the next year, a geologist who is thoroughly acquainted with clays and clay products. We are also associating with us men who are thoroughly familiar with the technical side of the ceramic industry.

I can assure you that we shall be very glad to coöperate with your Society in every way possible.

Would this Survey be eligible for membership in the Society; and if so would it be under the head of Corporation Members?

Yours very truly,

(Signed) Joseph Hyde Pratt, *Director*

SUMMER MEETING
THE CANADIAN TOUR

An Account of the Summer Excursion Meeting Aug. 13–20, 1922

By Alexander Silverman

The writer has been requested to prepare an account of the Summer Convention, just ended. If he becomes sentimental, or follows the flights of his fancy at times, it is only because he has had the fortunate privilege of being a party to what may unhesitatingly be termed the "most wonderful" tour ever afforded a group of technical men. "Perfection" is the only qualification which will properly fit the "Canadian Tour." Not a drop of rain marred the excursion. It was attractive technically, educationally, historically, scenically and gastronomically. About sixty members and their guests constituted the party.

Through arrangements made by Dr. E. W. Tillotson, the Eastern Ohio, West Virginia and Western Pennsylvania contingent boarded a special car in Pittsburgh on the Buffalo, Rochester and Pittsburgh Railroad at 10 o'clock Sunday morning, August 13th, in charge of Mr. Herrick, Asst. Passenger Agent of the road. Within an hour all were acquainted with each other. A word should be said here of the welding influence of our good friends, Mr. and Mrs. J. G. Kirk of New Castle, Pa. Arrangements were made by the railroad for taxicab and bus service at Rochester, where the group was conveyed to the steamer landing.

At this point members of the Society from other districts joined the party, which boarded the steamer "Kingston." Here was the first evidence of the perfection and detail with which the tour had been planned by our worthy Secretary, Dr. Ross C. Purdy. Transportation had been provided and rooms were available at once on a boat which was crowded beyond its cabin capacity. Sunrise found us in the much-heralded Thousand Islands, and at 10 o'clock we transferred at Prescott, Ontario, to the "Rapids Prince," which conveyed us through Long Sault, Coteau, Cedar, Split Rock, Cascade and Lachine Rapids, with their accompanying scenic beauty, to Montreal, from whose harbor we obtained a most impressive view of Mt. Royal.

Mr. G. Percy Cole of the Dominion Glass Company, local chairman, had buses at the station, and we were taken to the Windsor Hotel, where it was not even necessary to sign the register; our rooms were ready for us, as they were at all hotels subsequently visited. After dinner, an informal meeting was held, at which plans were formulated for Tuesday's schedule. Messrs. Cole, Johns and others addressed the gathering. Light refreshments and an informal smoker followed.

On Tuesday morning, we were the guests of the Harbor Commissioner on his private launch. After viewing the harbor, which, according to information furnished, is the only one in the world yielding a profit, we visited the enormous municipal warehouse and cold storage plant, which has just been completed. That this plant is conducted on scientific principles, was clear from the humidifying apparatus and ozonizing machinery installed to prevent evaporation, and ensure preservation of food stored in the building. Interesting evidence was furnished us also of the care exercised in the planning of the building, whose floors and walls are built of concrete having a heavy cork interlining for heat insulation. During the afternoon, the party was divided into groups, one of which visited the Consumers' Glass Company, operating semi-automatic bottle machines; and another the Gurney Foundry Company, manufacturing enamelled stoves and signs. A third group motored through the city and environs, visiting McGill University and other points of interest. Evening found us at the banquet table, where we were privileged to hear a most interesting address by the President of the King's Council. He emphasized the need for a correct history of the early relations between Canada, the mother country and the United States, so as to ever ensure friendly relations between our Canadian neighbors and ourselves. Other speakers were President Riddle and Mr. Chapman of the Chapman Engineering Company. Prominent officials of the Province of Quebec were introduced. A formality which characterized this, as well as all subsequent banquets, was the drinking of a toast to the King and to the President of the United States, followed by the singing of the respective national anthems. An interesting feature of the musical program was the rendition of a French Canadian song, "Alouette," whose tuneful melody at once appealed to our party; in fact, was our group song during the remainder of the trip.

Wednesday morning found us aboard two special parlor cars, provided by the Canadian Pacific Railroad, and in charge of Majors Burke and Omannay, representatives of the C. P. R. Mention should be made at once of the solicitude and care given us by these gentlemen, who accompanied the party as far as Kingston. They provided every facility possible, in fact were such an integral part of our group that we were loath to part with them. At 10.20 A. M., we arrived in Buckingham, where ex-Mayor "Bob" Cameron and Mr. N. B. Davis, superintendent of the Derry feldspar mine owned by O'Brien and Fowler, met us with a sufficient number of automobiles to motor the entire party some ten miles into the mountains. The product of the Derry mine is a snow-white feldspar of unusual purity and freedom from foreign minerals. After viewing the mining operations, we were guests at a camp dinner, where a French Canadian quartet composed of prominent business men of Buckingham, entertained us with more

of those delightful French songs. Following the dinner, addresses were made by Dr. McLish, Minister of Mines of the Province of Ontario; Mr. Davis, superintendent of the plant; Messrs. Frechette, Omannay, Riddle, Purdy and Silverman. A further inspection of the mine followed the luncheon, and then the party motored back to Buckingham to the special cars.

Six o'clock found us in Ottawa, the garden city of all Canada. Her magnificent buildings, with their Gothic spires, her canals and waterways, her exquisite natural beauty, can never be forgotten. Messrs. Davis, Frechette, Merkley, and Dr. Keele of the Ottawa Department of Mines, constituted the local committee in charge. Our domicile was the famous Chateau Laurier, than which no hostelry ever had more beautiful surroundings. As soon as rooms had been assigned, the party motored to "Ye Olde Homestead Inn" in Val Tetereau, Quebec, across the Ontario dry line. Dining and dancing were the program of the evening. Later some of our party visited the ceramic laboratory of the Department of Mines and the Victoria National Museum of Ottawa.

Thursday morning included excursions to the famous Eddy paper mills, which manufacture all types of paper and pressed paper products; and the Merkley brick plant, making shale brick and fire-proofing materials. Other members of the party motored about the city and suburbs, viewing the magnificent Parliament buildings, Agricultural Gardens, and additional points of interest.

At 11.40 A. M., we were again on the C. P. R., reaching Verona at 2.30, thence motoring to the Richardson feldspar mine, located in the hills overlooking Thirteen Island Lake. Here Mr. R. F. Segsworth, an attorney from Toronto, interested in the mines, and a real host, together with President Taylor of Queen's University, Messrs. Townsend, Gardner, and members of the Kingston Council, led our inspection of the mine, which produces a high-grade pink feldspar, beautiful white quartzite and other minerals, which were especially interesting to the collectors in the group. Sufficient time was available for some of the party to take a plunge into the crystal clear waters of the lake. Again a motor trip, and at 6.30 westward bound on the C. P. R. to Kingston, the "West Point" of Canada and the seat of Queens' University. Here at 9 P. M., we were the guests of the Kingston Council at a banquet which lasted into the "wee sma' " hours of the morning. The speakers of this occasion were Sir Archibald Howald, Head of the Royal Military Academy; Dr. Taylor; and Msssrs. Keele, Hostetter and Beecher. After the speeches, Messrs. Burke and Omannay of the C. P. R., who had to leave us at this point, were given an ovation. Following the banquet, we were conducted to the town hall to view illuminated memorial windows depicting the principal battles of the late war. Needless to say, we literally dropped into our berths in the special sleepers which carried us to Toronto.

The party arrived in Toronto at 7.30 Friday morning, going immediately to the King Edward Hotel. Toronto's local chairman was Mr. M. F. Gibson, a former pupil of Secretary Purdy, who furnished us with a mimeographed schedule, which indicated another busy day. At 10.30, we were the Harbor Commissioner's guests on several launches, which carried us through the gigantic harbor of the city and out to Toronto's various lake resorts. Our party lunched together at the King Edward, and in the afternoon split into groups, one of which visited the Standard Sanitary Manufacturing Company's plant; another that of the Jefferson Glass Company, where lighting ware is made; and a third motored through the city and visited the Queen's Museum, the University of Toronto, the Parliament buildings and the Exposition grounds. At dinner we were the guests of Mr. and Mrs. Abel Hansen, of Perth Amboy, New Jersey. These genial hosts had already won the love of every member of the party. The speakers were Brigadier General Mitchell, Dean of the Department of Applied Science of the

University of Toronto; and Messrs. Gibson and Riddle. Dean Mitchell outlined plans for a department of ceramic engineering at the University of Toronto, whose development will result in valuable coöperation with the ceramic, glass and mineral industries of Canada. After the dinner, part of the group visited "Sunnyside" (Toronto's Coney Island), and others gathered in the home of Mr. Segsworth, where they viewed the rare collection of paintings, etchings and engravings which he has collected with painstaking care. His art treasures also include precious ceramic and glass specimens.

On Saturday at 8.15 A. M., we left Toronto by boat for Hamilton, arriving at 11. Here Mr. H. F. Dingledine took charge of the party. After a visit to the Canadian Porcelain Company's plant, manufacturing electrical porcelain, and to the Libbey-Owens Sheet Glass plant, lunch was served at the Royal Connaught Hotel. Four o'clock brought sad farewells, and the party scattered, some bound for Canadian lake resorts, others visiting Niagara Falls, en route to their homes.

The Canadian tour furnished evidence of the splendid mineral resources of Canada, of her manufacturing enterprise, and of her real men and women who were our hosts on all occasions. Let me repeat what I have already said of Secretary Purdy. His wonderful eye for detail and anticipation of the comfort of every member of the party made the trip perfect, and never to be forgotten. This article may well be concluded by a psalm dedicated to Canada by one of our party.

"Canada is our hostess: we shall not want.

She motoreth us through green pastures, and leadeth us by rapid waters.

She restoreth our soul.

She guideth us into paths of interest, for our mind's sake.

Though we trail and shoot rapids of death, we fear no evil; her guides are ever with us.

Her grain and her vine, they comfort us.

She prepareth a table before us in the presence of our friends.

She maketh our hearts rejoice.

Surely her goodness and kindness will follow us all the days of our life; and she shall dwell in our thoughts forever."

NOTES AND NEWS

Past President Cullen W. Parmelee Designated as Acting Head of Department of Ceramic Engineering University of Illinois

BIOGRAPHICAL DATA

Born, Brooklyn, New York in 1874.

Graduated from Rutgers College 1896 with degree of B. Sc., and honors in Chemistry. Also, elected to Phi Beta Kappa in senior year for scholarship.

Editor-in-chief of the College Weekly.

Spent five years as chemist with the New York and Boston Dyewood Co., Brooklyn, New York, manufacturing natural dyeing and tanning extracts.

Returned to Rutgers College as instructor in Chemistry in 1901. Organized the Department of Clay Working and Ceramics in 1903 and was Director until 1916. Served as Associate Professor of Applied Chemistry from 1905–08. Professor of Ceramics 1908–16.

Appointed Professor of Ceramic Engineering at the University of Illinois, 1916. Acting Head 1918–1919. Designated Acting Head of the Department for 1922–23.

Served as Trustee, Vice-president and in 1914–15 was President of the American Ceramic Society. Chairman of the Committee appointed to consider the publication by the Society of a journal which resulted in the Society undertaking that enterprise.

Organized the New Jersey Clay Manufacturer's Association in 1914 and was Secretary 1914–1916.

Secretary of Illinois Clay Manufacturer's Association 1917–

Appointed District Chief for Illinois Industrial Furnace Section, U. S. Fuel Administration, 1918.

Member of the Joint American Foundrymen's Association and Division of Engineering, National Research Council Committee on Molding Sand Research.

Consulting Ceramist for Illinois Geological Survey, 1917–

Chairman Committee on Data, American Ceramic Society, 1922–

Member of American Society for Testing Materials, English Ceramic Society, American Chemical Society, Beta Theta Pi, Sigma Xi.

C. W. Parmelee

Author of numerous papers presented before the American Ceramic Society, also co-author of Report on the Peat Deposits of Northern New Jersey, published by the New Jersey Geological Survey, 1905; and co-author of Further Investigations of Illinois Fire Clays, Illinois Geological Survey, 1921.

Coöperative Research Work of Clay Products Associations

The Eastern and Western Clay Products Associations are joining their support of coöperative research work with the Mellon Institute of Pittsburgh. The purpose of this research work in general is to improve the quality of sewer pipe and to reduce the cost of manufacture. Their aim is to manufacture more uniform and stronger sewer pipe; one also that will better resist the action of sewage chemicals.

Clay sewer pipes have withstood the requirements of modern times in a satisfactory fashion, but it is that the sewer pipe manufacturers may be forearmed to meet the ever-increasing demands and ever increasing severity in requirements that they desire to improve their product, and at the same time manufacture it at lower cost.

Mr. Harry G. Schurecht, a long standing member of this Society, well known because of his researches and writings, is employed by these associations as their Fellow. A very brief sketch of his training is as follows:

Received B.S. in Ceramics at University of Illinois, June, 1914.

Ceramist for The Findlay Clay Pot Company, Washington, Pa. July 1, 1914 to September 1, 1915.

Laboratory Assistant in Ceramics at The U. S. Bureau of Standards, Pittsburgh, Pa., September 1, 1915 to April 1, 1916.

Ceramic Chemist, U. S. Bureau of Mines, Columbus, Ohio, April 1, 1916–April 1, 1922.

Fellow for the Eastern Clay Products Association, and The Clay Products Association, The Mellon Institute, Pittsburgh, Pa., April 1, 1922.

H. G. Schurecht

H. T. Shelley

He has just started upon the latter work, hence we can not at this time make statement as to what problems these associations will be engaged upon first.

G. F. Lenth

We herewith have the pleasure of showing the likeness of Mr. H. G. Schurecht, and also that of Messrs. H. T. Shelley and George T. Lenth.

Mr. H. G. Shelley is managing secretary of the Eastern Clay Products Association, municipal engineer of wide experience and reputation, an organizer, and one with appreciation of the need and benefit of plant control in improving quality and reducing cost of manufacturing of sewer pipe.

Mr. Lenth is Secretary of the Western Clay Products Association. He has had many years' experience as City Engineer, is widely known, and his counsel is sought wherever there are questions regarding the use of sewer pipe.

The American Ceramic Society is always pleased to see such coöperative contacts made, for thus, and only thus will the sum of our knowledge be increased. It brings contact of the collegiate institute with the industry, and the industry with the institute,—a happy and profitable combination.

Tests for Fire Brick

At the last conference, at the Bureau of Standards, with the Advisory Committee on Specifications for Refractories, which is made up of representatives of producing and consuming industries and interested technical societies, somewhat wide differences of opinion were expressed as to the proper test requirements for fire brick for the linings of stoker-fired boilers and it became apparent that a systematic investigation would have to be made before various essential points could be satisfactorily settled. As a result, Mr. Howe has made additional tests of something like forty different brands of fire brick at Mellon Institute, and an extended coöperative investigation has been undertaken at the Bureau of Standards.

At the request of Mr. E. B. Powell, Consulting Engineer of Stone and Webster, approximately forty large power house operators have sent to the Bureau for test, samples of the brands that they are using. By means of questionnaires sent to these power companies, Mr. Powell is collecting as complete information as possible on the service given by all the brands of brick represented. The correlated information will later be compared with the data from the tests. Practically all of the established tests for refractories and some additional tests are to be applied to all the brands received.

Several months will be required to do the work but it is believed that when this investigation is completed the information available from all sources will be sufficient to make it possible to arrive at definite and satisfactory conclusions as to what test requirements should be included in specifications for fire brick for stoker-fired boilers. As the brands of brick included in these tests are used in other types of service as well, the test data can be used in the preparation of specifications for refractories for other specific uses.

Oxidation of Ceramic Wares during Firing

From U. S. Bureau of Mines

In the study of the oxidation of ceramic wares during firing, being conducted at the Columbus, Ohio, Experiment Station of the Bureau of Mines, substantial progress is being made in the investigation of the rate of evolution of sulphur dioxide and trioxide at different temperatures and atmospheres. This work has reached a point where it was deemed advisable to check laboratory work with industrial practice. Samples of flue gases at all stages of the burn were recently collected at the plant of the Fallston Fire Clay Company, Fallston, Pa. Observations of the so-called "blue smoke" were made at this plant.

Calendar of Conventions

With the summer meeting now off of our Calendar of Conventions and already a matter of history, the most important event to plan for is the Annual Meeting in February, 1923. This meeting, which will mark the quarter century of the activities of the American Ceramic Society, is already progressing toward the completion of arrangements.—Notice that in this list this announcement stands out in large type—"There's a reason."

American Chemical Society—Pittsburgh, Pa., September 5–9, 1922.

National Association of Brass Manufacturers—Detroit, Mich., September 6–8, 1922.

Association of Iron and Steel Electrical Engineers—Cleveland, Ohio, September 11–15, 1922.

Eighth National Exposition of Chemical Industries—New York City, September 11–16, 1922.

American Electrochemical Society—Montreal, Canada, September 21–23, 1922.

American Institute of Mining and Metallurgical Engineers—San Francisco, Cal., September 25–28, 1922.

National Association of Commercial Organization Secretaries—Chicago, Ill., October 23–25, 1922.

National Society for Vocational Education—Detroit, Mich., November 30–December 2, 1922.

Dental Manufacturers Club—St. Louis, Mo., November 20, 1922.

Dental Exhibit of the Dental Manufacturers Club—St. Louis, Mo., November 21–24, 1922.

National Exposition of Power and Mechanical Engineering—New York City, December 7–13, 1922.

Mining and Metallurgical Society of America—New York City, December 7–13, 1922.

American Malleable Castings Association—Cleveland, Ohio, January 10, 1923.

National Jewelers Board of Trade—New York City, January 18, 1923.

Canadian National Clay Products Association and Western Ontario Clay Workers Association—Hamilton, Ont., January 24–26, 1923.

American Concrete Institute—Detroit, Mich., February, 1923.

National Association Builders Board of Control—Des Moines, Iowa., February, 1923.

AMERICAN CERAMIC SOCIETY—Pittsburgh, Penna., February 12–17, 1923.

National Gas Association of America—Louisville, Ky., Spring, 1923.

American Institute of Mining and Metallurgical Engineers—New York City, February 19–22, 1923.

National Association of Stove Manufacturers—Richmond, Va., May 9–10, 1923.

American Association of Museums—Charleston, S. C., May, 1923.

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EDITORIALS

OUR TWENTY-FIFTH ANNIVERSARY CONVENTION

February 12–17 Is the Date and Pittsburgh Is the Place

It was a quarter of a century ago that a few ceramists decided to found a society for the purpose of advancing the ceramic arts and sciences. It was an ambitious proposition then, a little in advance of the industrial demands but results have proven that the pioneer ceramists had a true conception of the industrial needs. What a contrast there is today from twenty-five years ago in the attitude of the factory operators on questions of technical control and research! The charter members of the Society should be given credit for their foresight; for anticipating the demand and for actually being the first and the prompting factor in the development of a demand in the ceramic industries for technical control and research. During these twenty-five years there has been a positive change from resistance to the advances of technical men to a demand for them by the industries that actually exceeds the supply.

Being a natural sequence to the graduation of the first class from the Ohio State University Ceramic Department in 1897 the attention of the Society was most largely confined to promoting ceramic education. The fundamentals of what is recognized today as ceramic science and technology were known to very few. There had been no correlation of the large mass of practical knowledge such as we have today. There were no ceramic

departments in the Bureaus and there were only scattered attempts to apply the fundamental findings of the scientists to factory problems. Much that the students in the ceramic course under Professor Orton were discovering and publishing for the first time is today taken for proven facts, the basis on which to further research.

Twenty-five years ago the Society could be nothing other than an educational institution. All, the plant operators and the scientists alike, had a very great deal to learn through investigations and plant trials. The "researches" of those early days were crude as viewed from the present time. They could not be otherwise for there were no established limits and no directions. It was pioneering even in the outlining of the investigations.

The Ceramic Department organized by Professor Orton was the first effort in ceramic education in this country. There were opposition and prejudice to overcome in establishing the Department of Ceramics at Ohio State University and he did not receive a very general support when, with the other charter members, he organized this Society. The founding of these two pioneer institutions required the mose persistent promotion.

Contemporary with the latter day activities of this Society, the several schools in turn established ceramic departments and the Federal Bureaus began ceramic investigations. To all of these enterprises the Society gave encouragement, moral support and in some instances, political help. A proper tracing of the growth of the Society in industrial influence and as a factor in ceramic education involves a history of all agencies that have added to the total of ceramic knowledge closely associated as they all have been and mutually dependent.

None would be so blind to the facts as to assign credit for the present status of ceramic knowledge and technology to the American Ceramic Society. But all the collegiate and federal ceramic departments, scientific and technical organizations, the technical press and industrial laboratories in this country as well as in other lands have contributed to the fund of knowledge that has been collected during these past twenty-five years. Our sister ceramic societies in England, Germany and elsewhere have been large contributors with the American Ceramic Society, pioneer among them all, maintaining the aggressive lead and doing the larger share.

The celebration of this twenty-fifth anniversary will be more than the observance of the founding of the American Ceramic Society; it will be the commemoration of the first collaboration of industry with the colleges and other research agencies, applying science and scientific methods in the analysis of and adding to the vast fund of practical knowledge already at hand. That collegiate ceramic departments, federal agencies and other ceramic organizations were later organized and have grown in strength and service is a natural sequence. They have given substantial proof that this pioneer Society was founded for a needed purpose.

It seems strange, as we view those early days, that in the light of our present-day experiences ceramic industries did little more than to tolerate the advances made by the American Ceramic Society. In contrast to the indifference of the plant operators in the early years of the Society, the several Trade Associations today are supporting joint researches and a large number of individual plants are employing ceramic engineers and maintaining ceramic laboratories.

This Twenty-Fifth Anniversary Convention will be the occasion for doing more than to establish facts regarding the developments in ceramic technology during the past years; it will be the opportunity for looking squarely at present-day technical and scientific needs of the ceramic industries and for making plans for the collaboration of all on a much more comprehensive plan. In this manner the immediate future will find the ceramic manufacturers ready to meet the more strict specifications of the purchasing public and the ever-changing industrial needs.

The history of the last twenty-five years in ceramic technology and art will be set forth in the January number of this *Journal*. This will be a thorough "Looking Backward" or inventory of the many things acquired during the past twenty-five years. This will leave for the Convention a survey of the present day needs and "Looking Forward."

The Board of Trustees, all standing committees and especially the Divisional officers and committees are making plans that this Anniversary Convention may be occasion for a larger realization of the need for aggressive fostering of technical and scientific research and especially as joint enterprises by industrial associations with collegiate and federal research organizations, as well as by groups by themselves. This should indeed be a profitable event for the ceramic craft.

DISCUSSION[1] ON "USE OF FORCED DRAFT FOR TERRA COTTA KILNS"[2]

MR. HOTTINGER:—I am sure we have a new subject, one that has never been brought up in the Ceramic Society to my knowledge, *i. e.*, use of forced draft in firing except possibly on some brick kilns, but never in the terra cotta industry.

MR. RADCLIFFE:—Mr. Chairman, about five or six years ago I was doing some work for the Kellogg Brick Company at Peoria. They were making common brick and paving brick. In one of their yards they had considerable trouble in getting the brick hard at the bottom of the kiln so we decided to install a forced draft system on their kilns. We tried it out on one of them that was particularly bad. These kilns were not very well constructed, and had a lot of leaks in them.

They were not able to get more than about fifty per cent of No. 1 pavers, and that burned all the way from nine to fourteen days to finish off the kiln.

This system that Mr. Carruthers describes is known as the Boss system of firing, in respect to method of inducing draft. In the Boss system they put a sewer pipe around underground, and used about one and one-half, or two horsepower for a twenty-eight or thirty foot kiln.

We were able to improve conditions wonderfully. We were able to get No. 1 pavers in the bottom of the kiln and in the center, and we got no over-burning whatever on the top near the bag walls, or any part of the kiln. Previously they were getting over-burned pavers. Sometimes they had to go in with a sledge hammer to get them out. After this, even at the bag walls they got no overburning. They got a percentage increase of twenty to thirty per cent. In other words, they got around eighty per cent No. 1 pavers. They were able to burn the kilns off in six days instead of from nine to fourteen, and they were able to use just the ordinary screenings instead of using fairly good coal. At that time, screenings were worth about fifty cents a ton, while the coal, mine run, was selling at about two and a half a ton. We used screenings entirely for the burn, and of course, made a very considerable saving, and at the same time increased the output of No. 1's, and the brick did not stick together at all. The temperature was very uniform.

Before the forced draft was installed, the smoke and fire seemed to be coming out on all sides of the kiln. They puttied those places up, and thus improved the conditions. As it saved fuel, and brought up the percentage of No. 1 brick, they installed it on all of their kilns. And there you have it. They are using it now, finding it very successful.

I never tried them out on a terra cotta kiln, the reason being that we had a different type of kiln there, and I was afraid of the very point that

[1] Terra Cotta Division, St. Louis Meeting, Feb., 1922.

[2] Carruthers, *Jour. Amer. Ceram. Soc.*, **5**, 449(1922).

Mr. Carruthers brought out; that burning of slack in that type of kiln would clog it up, and would cut down the draft, and so might be dangerous.

However, with the updraft type of kiln, I do not believe it would give any trouble, and it seems to me that it ought to be a very good burning method.

A MEMBER:—May I ask about how many times an hour you have to bait the fire boxes?

J. L. CARRUTHERS:—The fireman makes a coaling round about every fifteen minutes, depending upon the stage of the burn. After firing, he makes several rounds adjusting the draft.

A MEMBER:—I wonder if the whole thing doesn't boil itself down simply into a proposition of getting the fireman to fire more often.

MR. KLINEFELTER:—You know our problem is that in the day time you can usually get your fireman to fire once an hour, and the night man takes it about every two hours and a half. If you could get a fireman to fire every fifteen minutes you could fire all slack coal right enough, but you can not get them to do it. Of course, I can see the advantage of a forced draft; he is forced to fire every 15 minutes.

MR. GATES:—We try to fire about 15 minutes to one-half hour, depending upon the stage of the burning. In the early stages we do not fire as often as we do at high temperatures.

We had a little experience along this same line. We tried the forced draft system of burning about a year and a half ago, but our experience is negative, for some reason we could not make it go.

I can give you all the different kinds of different and conflicting conditions that we ran into. We would burn twice as much coal, and not make any heat, or half as much coal and make a lot of heat.

We never could find out what made it go and what made it stop. The main condition that we had was that of having no grates. We used simply a closed ash pit, and blew the air into it through a funnel. Of course one big difficulty we had was with clinkers, but they didn't bother us generally until we got to the point where they started to fuse. Even on some burns, we didn't have very much difficulty with the clinkers, and so I am of the opinion that if you don't get everything just right, you will have a lot of difficulty with a forced draft system.

We had flames shooting out of the top of the kiln, and we had the stack red hot. We could get the outside of the kiln very hot but we couldn't get the inside of it very hot.

I think that the main part of that difficulty is due to the fact that we didn't get a sufficient amount of air in over the grates. You can regulate that air in through the grates, so you can practically have a producer gas. It would be possible to make this a fairly good grade of producing gas. We saw it one time. We tried that at one time when we were trying to

make heat. We increased our firing, and there was no flame in the stack but the gas came out of the stack and then burned. Our experience was absolutely negative.

MR. HILL:—I am not surprised that Mr. Gates got negative results, because it is my experience that firing is a matter of the kiln design. If a kiln is designed for the other type of firing, it may not necessarily be adaptable to this, because you are changing your conditions entirely.

MR. GATES:—I might say that I believe that the Denver plant is using both the up-draft and the down-draft kilns. I don't know why it didn't work. We fired it not only every fifteen minutes, but every five minutes as well.

MR. MCMICHAEL:—I have visited a lot of places where it is successfully employed.

A MEMBER:—I believe he attributes considerable of the success he had had with this system to these boxes through which the air is introduced under the perforated plates. These boxes are welded absolutely air tight and my recollection is that he said before he got these boxes absolutely air tight, he could do nothing with this system.

MR. E. C. HILL:—This is very likely to happen. There are, though, other factors that enter into this particular question. One of these is the amount of gas you are putting through and the character of the gas.

The practice in an up and down type of kiln, is usually to burn coal which produces a good deal of gas and often that gas and air comes down into the flue and is not consumed at all but up the stack. That point was particularly brought out to me once when we failed to use Pocahontas coal. The fact was it took more coal to finish our kilns that it did with the Indiana coal, bituminous, with high volatile carbon.

In an up and down draft kiln you have a hundred or a hundred and fifty feet of flue to burn those gases through and this gas generated in the fire box finds enough air, and will generate enough heat to bring the kiln along evenly.

MR. RADCLIFFE:—I might say that the first time we made a burn on this we raised the temperature up to about eight hundred degrees Centigrade in 24 hours and then it stopped. We absolutely could not raise it any more. We just kept on firing and after about six or eight hours, it started going up again. It was at white heat on the top of the kiln where the pyrometer couple was, but the brick work down through had not heated, and after the brick had absorbed a certain amount of heat, then the temperature went on down. We found that it was very important to make flue gas analysis to get the proper CO_2 content. In that way you could save fuel by introducing only the proper amount of air.

T. L. CARRUTHERS:—I might add that it is necessary to adapt this system to the particular type of kiln upon which it is used. Likewise,

we have found that one type of coal does not work on all kilns. On some a heavy cooking coal is desirable, while on others a lighter long flame coal works best and on others a combination of the two coals gives best results.

DISCUSSION[1] ON "SOME EXPERIMENTS ON THE FIRE CRACKING OF TERRA COTTA"[2]

MR. HOTTINGER:—Mr. Hill has done fine work and his paper contains a number of very important and vital suggestions to the terra cotta business, and I would like to have this paper very thoroughly gone into and discussed.

C. W. HILL:—I agree with the Chairman that we have here a very profitable piece of work. I think that we all realize the extent of this trouble, and the amount of work that is going to be necessary before we really reach definite conclusions, and I want to urge that Mr. Hill go right on the way he is going, because he has started in the right direction; and if anybody else attempts to follow this up as closely as he has, it will mean a lot of duplication of work.

I am especially interested not so much along the line Mr. Hill suggests, *i. e.*, the further investigation of the composition of the body, although undoubtedly that is important, but in a little more extensive work on the rate of cooling with reference to temperature zones.

We have broad indications that terra cotta is more susceptible to changes in dimensions at certain temperatures than others, and that this is true of the strains which relate to certain zones. That is, we can probably cool very rapidly through one zone, directly after the firing, then possibly there is a lower temperature where we have to cool more slowly. Finally, I have the feeling that the temperatures below those indicated in the charts are equally as important as the others. We should know how low we can cool a piece of work before we take it out of the kiln, without subjecting it to the dangers of the atmosphere. I do not think we know this exactly, but the lowest temperature is when all of this dangerous contraction has taken place. If we could determine it, it would be of very practical value.

There is one interesting point in connection with the Crossley and Enterprise clays. We have noticed that the Enterprise clay has changed materially in its properties during the past year, and we have found that the sand content is lower, so that Enterprise clay now is about the same as Crossley clay, and there is a material difference in its physical properties such as shrinkage.

Crossley clay has also changed considerably over what it was a year or

[1] St. Louis Meeting, Terra Cotta Division, Feb., 1922.

[2] E. C. Hill, *Jour. Amer. Ceram. Soc.*, **5**, 299 (1922).

so ago, so that it is possible that some of the conclusions that Mr. Hill drew from his analyses would not necessarily be pertinent at the present time.

I think that we have something here that is of extreme value to us, and I hope that Mr. Hill will carry along not only the lines that he suggested but also the matter of the right cooling, with reference to the special cooling zones.

E. C. HILL:—In regard to the Enterprise clay, I would say that these trials were made more than a year ago from shipments of clay made in 1920. Shipments of this clay, as Mr. Hill (C. W.) says, have shown a marked improvement, particularly in the reduced sand content.

MR. MATHIASEN:—I ran into some dunting last summer, and when we looked for the cause of it, we found that our last carload of sandy clay, which came from Woodbridge had an abnormal amount of free sand. So I was interested in that Pennsylvania sandy clay. I understood you to say that you had the most firecracking with that material, didn't you?

E. C. HILL:—Yes.

MR. MATHIASEN:—Did you find out how much sand there was by analysis?

E. C. HILL:—No determinations were made of the sand content in the clays in Series I. The sand retained on a 200-mesh screen was determined on the terra cotta clays in Series II.

MR. MATHIASEN:—To check up what he said then about this crazing, I understand you think fire dunting comes from free sand.

E. C. HILL:—I think a sandy clay is more likely to firecrack than a non-sandy one; but you can not tell whether it is going to crack or not until you try it. The amount of sand that is contained does not always indicate its character.

MR. F. B. ORTMAN:—On the question of the effect of sand in the body in causing cooling cracks, I think it should be noted that the tendency to cool-crack is not always increased in proportion to increase in silica content of the body regardless of the character of the other constituents of the body. It is quite possible that a certain silica content might be perfectly harmless in this respect whereas in another body it would be very detrimental.

On the Pacific Coast, certain companies use bodies of a very open structure in which a very high percentage, in some cases as high as 30% to 35% of a material, known locally as Ione sand, is used. This Ione sand is a mixture of pure china clay and fine-grained silica, in proportions of approximately half and half. In the use of a certain body containing 30% of this material, there would, therefore, be 15% of pure sand, which when added to the silica introduced by the other ingredients of the body, would probably bring the total silica content easily above 20%. I know of such a body to have been in use for two or three years and when upon learning of the high silica content, I made a special effort to look into the

matter of cooling cracks, and much to my surprise, at that time, found that the material manufactured with this body was practically entirely free from any cooling cracks whatsoever, even though no special effort had been made to cool the kilns carefully.

The explanation obviously lies in the fact that the body as a whole was of a very open structure and that the silica was exceedingly fine grained, so that whatever volume change took place in the silica grains themselves did not exert any decided action upon the piece as a whole.

One other point I wish to make is in reference to the rate of cooling. If we could be absolutely certain in cooling a piece that we were cooling all parts of that piece at exactly the same rate, we could, no doubt, cool very much more rapidly than we do now. In my opinion, a great deal of the trouble from firecracking is due to strains that are set up by unequal cooling of different parts of the same piece. In the cooling of an ordinary periodic kiln, certain drafts are set up through different portions of the kiln and it is certain that in many cases a part of one piece may lie in this draft or current whereas the remainder of the piece may lie in relatively still atmosphere. That portion of the piece lying in the draft would undoubtedly cool faster than the remainder of the piece and would set up a strain which might very easily cause the piece to crack. This would indicate that the method of cooling is of even more importance than the rate of cooling.

If some means could be devised for eliminating the difference in the rate of cooling in the different portions of the kiln, it would go a long way toward eliminating firecracking.

Mr. Sheffield:—I missed the point as to what effect more grog has on firecracking.

E. C. Hill:—Increase of grog reduces the tendency to firecrack. I might add that when all grog finer than 40 mesh was used, the tendency to firecrack was quite marked. When all grog coarser than 40 mesh was used, there was much less tendency to firecrack. However, the body with the grog coarser than 40 mesh did not seem to be appreciably better than the body containing both fine and coarse grog, so that it is hardly likely that the tendency to firecrack could be greatly reduced by taking out the fine grog.

Mr. Hottinger:—There is one point I would like to make here; that is the sand in the body itself.

It seems to me dependent on the character of the clay itself, that is, if we have a very dense burning clay and we add sand to it, we are going to have set up a great many more strains than if we had an open burning type of clay which is not so dense, such as is able to resist the strain of the individual expansions of the sand particles themselves. When we speak of sand in the body and what effect it would have, we always have to keep in view the character of the clay bond.

C. W. Hill:—In that connection, I think we should realize that this work is being done in a practical way. We could not do it in the most scientific way on account of the time, but it seems to me that we are putting all of these different bodies of clay through more or less the same temperature treatment, and are comparing results. If we could determine the most advantageous cooling rate for each one of these different bodies, we might have entirely different results.

Mr. Radcliffe:—I do not know, but as an opinion, it seems to me that a clay and a grog should have very nearly the same absorption for the burning of terra cotta. In other words, if we are going to have a body with an absorption of 10%, our grog and clay both should be fairly low in free sand or silica, and they both should have about the same absorption. With a vitreous and a porous body, it seems to me that there is sure to be a difference in the expansion and contraction of those two materials, which will set up a strain.

It seems to me that a good experiment to make along that line would be as follows: Have some of these clays washed; calcine the clay in the regular kiln and then make a body, using 35 or 40% of this calcined clay and the raw clay; grinding the grog to various grades of fineness, and then putting them through a test by heating it up to a certain degree of temperature, and then plunging in water. I believe that would be a quick method of determining whether or not they have a tendency to cool and crack.

I would like to have an expression on that as a method of testing those materials.

A Member:—We had occasion recently to make a harder body on a small job and we used one of our tight burning clays. On this particular order we got firecracking. That is a case where calcined clay was directly responsible for firecracking. We had been replacing sagger grog by a calcine of one of the clays used in the body.

A Member:—Was it a sandy clay?

A Member:—No.

A Member:—What porosity or what absorption?

A Member:—It was the tight burning clay; its absorption was one and one-half to two per cent; one of our tight burning clays.

Using the same mixture of clays, we got a lower absorption using porcelain grog than we did when using sagger grog. By substituting the calcined clay grog for the porcelain grog, with this same mixture of clays, we got about two per cent. We also got firecracking. This small order was burned in the regular kiln with other material made of the same clay but using sagger grog. The cracking apparently was not due to the clay. It was the small particles of the distinctly different material. That is the only cause I could see for firecracking in those particular pieces.

A MEMBER:—There is no question but that a dense body will cause cool cracking.

E. C. HILL:—The only way to determine the effect of the density or porosity on the tendency to firecrack would be to fire the same body through a range of temperatures. I did not do this because I did not wish to fire our kiln very much above cone 6. I considered adding various amounts of fluxes to the body and so get bodies of different porosities, but this would be determining the effect of the fluxes on the firecracking tendency, rather than the effect of porosity.

A MEMBER:—I differ with Mr. Hill on the use of Campbell's clay. We also have used a body made entirely of Campbell's clay and grogged on a small order and had no cracking.

E. C. HILL:—I would like to make one more point in this connection. Six years ago some experiments were made with various bodies made into rather large pieces. One of these bodies contained 65% of Campbell's red clay and 35% grog and was fired at cone 6. This body had an absorption of about 9% and there was no firecracking on the trials whereas there was considerable firecracking on the trials of the bodies with the more sandy clays with absorption as high as 17%.

MR. HOTTINGER:—In speaking of this Campbell clay, I believe it to be a clay containing a rather high amount of iron.

Now, possibly all terra cotta men who have had experience in years gone by, that is, in the time when we had a lot of red colored body, remember that some of those bodies were practically as hard as granite. I can recall very distinctly that in those days, we had very little trouble with firecracking.

DISCUSSION[1] ON "REFRACTORIES FOR OIL-BURNING FURNACES"[2]

1. **Fire Clays.**—(*a*) For the raw fire clay batter or dope used in laying fire brick. Required analyses of these clays from the principal beds now worked for commercial use. (*b*) For "target" oil firing to receive impinging oil flame and to maintain incandescent mass of refractory material, as flint clays; and so to utilize most fully the principles of surface combustion.

2. **Refractory Tile.**—Use of refractory tile or baffle, flat and segmental, to receive impact of oil flame and utilize maximum heat transfer, by radiation therefrom, and so to reduce to a minimum the heat transfer by convection from the oil flame.

3. **Fire Brick.**—The manufacture of high duty fire brick for oil fired furnaces. Required: typical examples of successful application of

[1] Refractories Division, St. Louis Meeting, Feb., 1922.

[2] See Grant, "Refractories for Oil-Fired Furnaces and Boilers," **4**, 390 (1921).

these fire brick under the extreme conditions of temperature, and the characteristic flame action of all burning equipment.

4. **Refractory (High Temperature) Cement.**—(*a*) For laying the fire brick, instead of raw clays batter. (*b*) For washing or coating of the finished surfaces to secure all joints against erosion and penetrative effects of flame action.

MR. GREAVES-WALKER:—This is a large order. Instead of taking up this question by sections, we shall discuss it as a whole. There is no doubt that the subject of refractories for oil-fired furnaces is a live one. There is probably more loss encountered in supplying refractories for this use than in anything else we run into. The use of fuel oil is growing. Extremely high temperatures can be obtained. Furnace temperatures around 3000 to 3100°F (the softening point of most No. 1 refractories) is easily and often obtained with oil as a fuel. Further, there is a physical reaction of some kind that destroys fire brick in an oil furnace.

An instance came to my notice a few days ago of an oil fired railroad tunnel kiln. I noticed the saggers were set so as to have a wide channel through the center of the car. These cars were not pushed continuously through the kiln but pushed down one car at a time. These openings came directly in front of the burners and the flame shot straight through between the saggers. I asked why this was found necessary and was told that in three or four trips through the kiln the saggers would be destroyed if the oil flame was allowed to impinge upon them, but by allowing the flame to shoot between the saggers they could get about 75 trips out of a sagger. Under the flame action the saggers rotted—they did not melt or crack but they became rotten and were of no further use.

That is the same difficulty they are having with refractories in the linings of oil-fired furnaces. The fire brick actually rot under the oil action. My theory of it is that the oil being shot into the furnace in a fine spray is impinged upon the brick and minute globules of oil vapor are exploding on the face of the brick constantly. It is a very small explosion but you have millions of them occurring every minute and it gradually destroys the surface of the brick. If it is a thin section it will destroy the whole section, or at least make it shaky. There is no noise attending except the roar of the oil going into the furnace, but there is an ignition that is instantaneous, taking place on the surface of the brick. Presumably, this action is what destroys the face of the brick or causes the difficulty that is encountered with brick in this service.

A number of people are using very hard and very dense carborundum bricks. It is claimed that they stand this action without difficulty. It seems, from these refractories having stood up, that if we could get a refractory brick that is as hard and as dense as a carborundum brick it would stand this particular action to which the brick is subjected and

which has been found so destructive. I have no doubt there are a number of men here who have run into difficulty in supplying brick for oil-fired furnaces. I think there is plenty of chance for discussion on this subject.

THE CHAIRMAN:—Dr. Endell, will you tell your experiences on the other side, with refractories in oil-burning furnaces?

DR. ENDELL:—We have no oil in Germany.

PROF. PARMELEE:—Are you using no oil furnaces?

DR. ENDELL:—We had a small open hearth furnace, five tons only, heated with oil. I remember the lining lasting for only five days. Oil is too expensive in Germany, hence we do not use oil there except on a small scale.

MR. GREAVES-WALKER:—There has been, since the war particularly, a very strong tendency to equip steamships for oil burning; in fact the United States Shipping Board is specifying oil-burning boilers and some of the coal burners have been changed to oil. Although using only number one refractories they have to keep continually relining their boilers. A ship making a trip from New York to San Francisco will have to reline its boilers at the end of each trip. Some of these boilers take 8,000 bricks for a single unit. In making a trip to the Mediterranean they will stop at Gibraltar and reline and possibly again at the Suez canal as they come back. This indicates to some extent what the problem is and what the expense is.

MR. HOWE:—There are several points which come up from time to time in connection with the use of fire brick in contact with oil that may be worth while to bring up at this time. For instance, where the American brick comes into competition with the foreign brick, such as the "Glenboig," it is noticed that the dense finely-ground Scotch brick seem to stand up very well as compared to the more open American brick. When American bricks were compared, the denser seemed favored decidedly.

We have this oil problem in the manufacture of gas. The bricks used there come in contact with the oil that is sprayed in and the bricks finally disintegrate. This disintegration could hardly be due to temperature changes alone. The amount of disintegration varies to a great extent, sometimes taking place after one or two hundred burns, sometimes running up into the thousands. Another condition that may figure in this is the formation of carbon monoxide and everybody who is familiar with the operation of these furnaces knows that with a temperature of 3000°F, the conditions are present for the formation of this carbon monoxide.

MR. GREAVES-WALKER:—One of the peculiarities I have noticed in connection with the use of carborundum brick; if you will examine a carborundum brick you will notice it has a peculiar skin and there are

instances that have come under my observation where carborundum brick would stand up without any signs of failure for a certain length of time, 6 or 8 weeks, or possibly longer, and then they would go to pieces almost all at once within a few days or a week after they started to disintegrate or after they passed a certain stage. I wondered whether the fact that the brick would stand up for a certain length of time and then fail was not due to that skin being ruptured and the brick then being unable to resist any longer whatever action to which it was subjected.

I also wondered whether it was not possible for a ceramic engineer to develop a skin for an oil-fired brick. If he could develop some sort of a coating or glaze on the surface of the fire brick making in effect a fairly dense high grade fire brick there is not the slightest question but that they would stand up better because they now do stand until this "skin" is destroyed.

Mr. Geiger:—Mr. Greaves-Walker, in telling of the sudden failures of carborundum brick and in mentioning the difficulties experienced in maintaining clay refractories in oil fired marine boilers, has brought up several points that are of great interest.

The sudden failures of carborundum brick have been due largely to improper initial firing of this refractory. Before the difficulties were understood and the failure encountered, insufficient attention was paid to the burning. The result was that the brick were soft in the center and had only a very thin skin of properly developed material. After much experiment it was learned that a very elaborate and costly burning practice was necessary to properly mature carborundum refractories. Since this has been put into operation these sudden failures have been overcome, for now the entire body of the refractory is hard and dense instead of merely the surface. Other improvements have been effected, and carborundum refractories produced in the past eight months are decidedly superior to those previously made.

In the introduction of a new refractory numerous failures are met. Of course there is no universal refractory, but to determine the limitations of a new product it is tried in many places where there is every reason to doubt the possibility of success. In many instances too, a new refractory is put into places where the tried refractories are very short lived with the hopes that, through some combination of circumstances, some economy may be effected in the long run.

Details of manufacture had to be learned through failures. Carborundum refractories have failed because of misapplication and because it did not develop at first that they could not be fabricated and burned just as clay refractories.

Mr. Greaves-Walker has spoken of the necessity of replacing fire-clay linings in steamship boilers practically at the end of every trip from coast

to coast. The labor costs in installing new linings and the losses attending the holding up of the vessesl are far greater than the actual costs of the refractories ordinarily employed.

The Luckenbach Steamship Company has purchased a great many carborundum brick for their oil-fired ships at an initial cost of ten or twelve times the price of clay brick. At this time the oldest of these linings has been through five, thirteen-thousand-mile trips without any repairs whatsoever. This means that the labor costs on relining furnaces for four trips has been saved and that the boats have not been tied up pending replacements to refractory settings.

Another installation for which we have more specific figures can be mentioned. At the plant of the Mitchel-Bissell Company, manufacturers of porcelains for the textile industry, oil-fired kilns are run to cone 16–17. Repair costs to combustion chambers lined with clay refractories amounted to $2,000 in eight months. Carborundum brick, costing $500 were installed and the kilns at present have been in operation over fourteen months with no combustion chamber repairs. Apparently, moreover, the brick are just as good as when they were installed.

With carborundum brick of the quality now being manufactured, we have not had a single report of failure in oil-burning furnaces of any kind.

Mr. Laird:—I would like to know how important the question of salt in oil is. I have known of several instances of the failure of refractories under oil firing apparently due to some material coming from the oil.

Prof. Parmelee:—I understand this trouble is peculiar to certain oils, especially those of the Pacific Coast, if I am correctly informed.

Mr. Greaves-Walker:—You have heard of the success of the carborundum brick in solving this problem of oil-burning furnaces, but I do not think that the fire clay brick manufacturer need be discouraged. The fact of the matter is, he has something to aim for. There is such a large difference between the price of clay brick and carborundum brick (and probably always will be) that the field is certainly worth getting into. I think it is one that will bear some study and some thought on the part of the fire clay brick manufacturer. Experience has shown that there are very few ground fire clay mixtures sold for laying up fire brick that are suitable for use in oil-burning furnaces. This is probably due to the fact that the ground fire clay almost invariably has a lower fusion point than the brick it is to lay up. Consequently, the mortar joints are the first to be attacked by the high temperatures encountered and this in turn subjects the weakest part of the brick (the edges and corners) to attack.

The original question suggested for discussion asked that analyses of clays suitable for this purpose be given. This information would not be of great value, but it can be said that for the average oil-burning furnace, fire clay mortars fusing below cone 32–33 should not be used.

For "target" oil firing, walls or baffles built of brick or tile have not proven successful. Recent experiments have shown that "targets" built of calcined diaspore in lump form analyzing 85% Al_2O_3 or above, will solve the problem. These "targets" are built in the same manner as a rustic boulder fire place, the mortar joints being of the same material as the lumps. High grade flint fire clays have been used for this purpose, but have a tendency to disintegrate or break down.

Refractory tile or shapes when used to receive the impact of the oil flame have not proven generally successful due to the fact that severe disintegration takes place and where there are wide variations of temperature, the shapes crack.

Very few, if any, of the brands of high heat duty fire brick have consistently stood up in this practice. Results have shown that the conditions require a super-refractory. So far two brands of super-refractories have proved very generally successful. These are put out under the trade names of "Arcofrax" and "Carbofrax," the former being a high alumina refractory and the latter a carborundum refractory.

The market has recently been over-run with so-called high temperature cements. Many of these have no merit whatever as refractories on account of their comparatively low fusion point. Some of them are simply ground ganister with an addition of sodium silicate and others are nothing more than a mixture of ground fire-brick bats and clay.

Asbestos, talc, and many other like materials, to which a bonding agent has been added, are also used. About the only thing that can be said in their favor is that they have a cold set, *i. e.*, they will set up before heat is applied and this property is always obtained at the expense of refractories.

High alumina cements such as arcofrax (pulverized), the carborundum cements when not diluted with too much fire clay, and ground chrome ore, have all proved very effective when used in laying up brick work in oil-burning furnaces. On account of the variation in thickness which is experienced in even the best brands of refractories, a better job can generally be done with the super-refractory cements if the brick are all laid with a trowel instead of dipped. With a trowel a perfect but thin joint can be made that takes up any inequalities on the edges of the brick and thus prevents the oil flame from getting a start in the thin opening generally left when brick are laid up by the dipping method.

There is no question but that considerable protection is given the brick work by a coating of a high grade super-refractory cement, although unless new coatings are applied the protection is only temporary as the original coating is soon disintegrated and disappears.

DISCUSSION[1] ON "A MODIFICATION OF THE MOLECULAR FORMULA FOR GLAZE AND ENAMEL CALCULATIONS"[2]

MR. STALEY:—It seems to be taken for granted that I am entirely opposed to the use of molecular formulas in compounding enamels. Personally, I have never been able to use the molecular formula with any success, and for a good many years I have used calculated melted weights instead of the molecular formula. If others can use these formulas I am willing to concede they can do something that I can not.

MR. DANIELSON:—It seems to me that the only materials Mr. Hansen has definitely placed are the fluorides. I can give him a formula similar to his example by using a combination of feldspars for which it would be impossible to figure the batch even from this molecular formula. Some of the potash, for instance, may go in as nitrate or as feldspar, hence, it is impossible to figure definitely just how much of the various constituents, potash, soda, etc., is derived from the various batch materials unless the exact chemical analysis of each is known.

MR. HANSEN:—When expressing a formula in terms of materials used so that it can be duplicated by another worker, we should know the composition of such materials as feldspar. It is not sufficient to state that "four hundred pounds of feldspar was used in this enamel" and expect that any feldspar will produce the same results. We do not have pure feldspars. To duplicate results with different feldspars on any sort of formula scheme of expression, the composition of feldspar must be known. I admit that this formula does not establish the identity of all the constituents.

You have to use a certain amount of reasoning in the interpretation of a chemical analysis, and it is no better than the way you interpret it. The scheme here proposed reduces to the minimum the uncertainty in the reasoning employed. The old formula admits of greater misinterpretation of the fluorides and this modification certainly does establish the identity of the fluorides and seems to me to present certain advantages which are worthy of being taken into consideration.

MR. LANDRUM:—We will all agree that graphic methods for the representation of facts are highly desirable. The writer of this paper has gone one step farther in giving us more data in a graphic form than is given by the old Seger molecular formula. However, it seems that he may have lost something of simplicity in so doing, for instance, in the fact that we can not tell what feldspar he used.

What is the advantage of this graphic formula over actually giving the batch mixture to start with? I think that no paper should be given, for no paper is otherwise of any use whatever, that does not give the batch

[1] Enamels Division, Feb. 28, 1922.

[2] J. E. Hansen, *Jour. Amer. Ceram. Soc.*, 5, 338 (1922).

mixture. I would take for granted that, if the author's purpose is to give information, the batch mixture would be given.

Comparison of batch mixtures is an impossibility unless they be on a unit basis. I have had fellows ask, "What do you think of this formula?" No one can tell anything by looking at the batch mixture. Why not go one step farther and calculate the melted weights, taking into consideration the gases that go up the chimney. This is Mr. Staley's method of melted weights. A man can, by looking at two formulas, in terms of melted weights, make intelligent comparisons.

You have, even with Staley's method, so many factors to take into consideration, especially with nineteen or twenty ingredients, that no quick conclusion can be drawn.

Each one of the materials that goes into the batch mixture adds certain things to our final analysis. It adds those things that we all find in the chemical analysis. The research worker who is trying to duplicate an enamel, with only the finished piece of ware as a sample has a very difficult proposition. Anyone who has tried to do this, even with analyses that were correct, knows that he has just this same sort of synthetic problem that you have with ordinary molecular formulas. In other words, the Seger molecular formulas are those from which the analysis of your formula is made. To work backward from either you will have to use a great deal of ingenuity and much resourcefulness, and, before you have any success at all, a lot of experience in the actual making up of many batches of enamel.

I think that this method of representing the batch mixture, giving the fluorides in place of oxides, is a good one. The old molecular formula had all the soda grouped, no matter where it came from, as well as all the calcium oxides, etc., and certain comparisons could be made directly and quickly.

If you are going to get away from the simplicity of the molecular formula, I would just as soon get away from it altogether. I do not believe in taking percentage compositions of the actual materials put into the batch. What I mean is to carry that one step further and take the molecular weight and divide it into pounds, thus obtaining a factor which represents the number of molecules.

I do not see any advantage in stopping where you have. Why not, in that same form, put all the factors in one column and have them in the molecular proportion, that is, the equivalent proportions. I do not see what advantage you have gained by putting calcium fluoride in the column with the RO_5 and not putting sodium oxide there when part of it comes with B_2O_3. It really does not tell you all any more than the molecular formula, and it does lack the simplicity of the molecular. Fluorine generally has been given with the acids simply to show how much of the

soda is present as cryolite, how much of the lime as fluorspar and how much carbonate.

We do not say this molecular formula represents the final analysis of the enamel. It is simply the representation of certain facts, and we might each one use it for our own problems and publish it in our own way. I think in general we should adopt some method to present these facts. I think the old molecular formula combined with the old batch mixture tells a whole lot.

We have to go one step further to Staley's method. The ultimate composition of an enamel can be interpreted in a dozen different ways, using in one case cryolite to furnish the alumina and in another, feldspar, and still another, the oxide; and each will give a radically different result. Cryolite acts as cryolite, not as sodium oxide and fluorine. Nor does cryolite act as aluminum fluoride and sodium fluoride. I still maintain that in our papers we must give the results in terms of batch mixture as well as molecular formula.

MR. HANSEN:—Mr. Landrum brought up several points that came through my mind when I was working this out. I will admit the old method of the molecular formula used in most papers on enamels and glazes has the utmost simplicity, but in order to interpret it correctly, we have to have the original batch formula. Mr. Staley brought that out some three or four years ago in the *Transactions*. In other words, we have to keep two tables in mind when interpreting the formula. We can go to the other extreme and express our formula in terms of equivalents of each of the constituents, so many equivalents of fluorspar, so many of soda ash, sodium nitrate, etc. It seems to me, though, that such a formula would be too complex. We have to draw the line somewhere. Cryolite acts as cryolite, not as sodium oxide, aluminum oxide, and a certain amount of fluorine. This is shown by this proposed form of expression. I had to draw the line between the utmost simplicity and a certain amount of complexity.

DISCUSSION[1] ON "THE GREEN STAINING OF CLAYWARE"[2]

MR. HOTTINGER:—On this subject, I am sure we all have had some experience and probably some contradictory experiences.

MR. ALBERY:—There is one thing that we have probably missed in Seger and that is the article on green discoloration of light-colored bricks, and if you will look on page 359, Vol. I of the Collected Writings of Seger, you will find he referred to an organic growth that occurs on light-colored bricks in a moist and humid atmosphere; a growth of algae. When I was working for Mr. Gates, we had some experiments made to test this out.

[1] Terra Cotta Division, St. Louis Meeting, Feb. 28, 1922.

[2] Hill, *Jour. Amer. Ceram. Soc.* (*Bull.*), **5**, 51 (1922).

Seger recommends an insecticide as a preventive but not as a cure for the same. The insecticide naturally prevents this organic growth. We used a zinc sulphate solution, and were able to prevent the green discoloration from developing.

Mr. C. W. Hill:—The organic stain mentioned by Mr. Albery is of course a different matter from stains or suspensions. The organic growth may be differentiated from the other by inspection or by microscopic examination and may be burned whereas the inorganic green stain on ignition gives a black residue. There need be no confusion as to the two kinds of stains.

Mr. Hottinger:—I should like to ask Mr. Hill whether he tested for vanadium?

Mr. C. W. Hill:—We did not test for vanadium. Since we obtained such a copious test for iron and silica (possibly alumina too) which would indicate that the material was almost entirely an iron compound, it seemed needless to bother with any small quantities of other substances. The large amount of iron was enough to explain the coloration.

As stated in the paper, as Seger's analysis showed no iron there may be green stains due to vanadium and not to iron. Our contention is merely that the stains which we have examined are due to iron compounds. Because of failure to get an iron test easily, it is probable that some stains have been attributed to vanadium that were iron stains. Certainly before blaming it on vanadium, one should make certain that the stain is not due to iron compounds.

Mr. Albery:—The one sure preventative for the appearance of green discoloration, organic or inorganic, is the use of impervious slips.

DISCUSSION[1] ON "A NEW TYPE OF GAS-FIRED VITREOUS ENAMELING FURNACE"[2]

By A. Stockstrom:—After three months of operation we have no fault to find with our gas-enameling furnace; in fact, the results have been more than satisfactory. The quality of our ware has improved, our cost of production has decreased and the service from the enameling department to the assembling departments has greatly improved.

Having previously used only coal fired muffle furnaces, with which temperature control is very difficult, we attribute the improvement in quality not only to the fact that the enamel is fused at a decreasing temperature, but also to the accurate burning temperature obtainable. The flexibility of control also makes it possible to quickly change the kind of ware being burned or the kind of enamel, which is a great help in a plant

[1] Recd. August 1, 1922.

[2] H. H. Clark, *Jour. Amer. Ceram. Soc.*, 5, 478 (1922).

where many different parts are needed daily in order to keep the assembling departments supplied.

However, our main object in trying a furnace of this kind was to get away from furnace breakdowns and the consequent expense and interruption of production. Our furnace has now been in use approximately 2,160 hours and the brick work is apparently in the same condition as when put in. During this time it has been entirely shut off every week from Saturday noon until Monday morning.

On Monday mornings it takes about 40 minutes to bring the furnace to working temperature.

We use artificial gas of 580 B.t.u. per cu. ft. quality and our consumption from April 14th to May 15th was 835,000 cu. ft. or total cost for gas $710 during which time the furnace was in operation 510 hours, which shows an average hourly gas consumption of 1640 cu. ft. per hour or an hourly gas cost of $1.40 with gas at $.85 per 1000 cu. ft. During this time we turned out 137,700 sq. ft. of ware with this furnace or 270 sq. ft. per hour, which gives us a fuel cost of $.52 per 100 sq. ft. The ware consists of flat sheet iron parts ranging from 24 to 18 gauge.

We are not able to determine at this time the exact saving as compared to coal furnaces as we do not know what the life of the gas furnace will be, but from all indications the furnace will need no repairs for some time—in fact, it should last almost indefinitely.

American Stove Co.
St. Louis, Mo.

DISCUSSION[1] ON "PHYSICAL DEFECTS IN TANK BLOCKS"[2]

Mr. Loomis:—This investigation was made for the Corning Glass Works. We examined the structure of a number of tank blocks to determine the number of fissures. We chose several makes which we had in stock and took blocks from carload shipments. These blocks were cut into sections about 3 inches thick, and note was taken of the number of fissures and other defects present. There was only one make of block examined which proved to be totally free of fissures or defects.

I believe it is generally conceded that fissures are detrimental to the life of the block, and therefore to the life of the tank, since the glass penetrates the fissures, especially if they are of any size. In all cases but one, we found fissures varying from $1/4$ to 3 inches in length and quite a number of holes $1/4$ inch in diameter. Some of the blocks were very badly laminated; but in one case there were no defects of any sort in the three blocks chosen. The blocks examined were taken at random from the shipments. It looked as though one maker, at least, had found a method

[1] St. Louis Meeting, Feb., 1922.

[2] Loomis, *Jour. Amer. Ceram. Soc.*, **5**, 102 (1922).

of making perfect blocks, or was using closer supervision. This paper was presented with a view of pointing out the possibility for improvement and was written from the standpoint of the glass manufacturer rather than the block maker.

MR. ZOPFI:—I would like to ask Mr. Loomis if the block that showed no defects gave a longer service than the blocks that showed defects.

MR. LOOMIS:—In this particular case, they did not, but other things being equal, the better-made block, it is to be expected, would give better service. I do not believe any body will disagree on that.

MR. ZOPFI:—I grant you that, Mr. Loomis. We had occasion within the last six months to examine some blocks that were perfect in mechanical structure and denseness but they did not compare in service with blocks that we knew to be defective, that is, which had laminations and fissures.

MR. BROWN:—Several years ago I saw a bottle tank that lasted less than four months. The reason was sought. Examination showed many places where glass had penetrated nearly through the blocks. The blocks not only had spalled unduly but large pieces had cracked off where the glass had eaten back into the fissures. Many voids existed in the blocks and at some of these holes finger prints were easily seen on the clay. In making the blocks not sufficient care had been used in bonding the different layers. This instance was an extreme case of fissures in blocks.

MR. LOOMIS:—There is more of a chance of the blocks being rapidly attacked if made with fissures or laminations than without them. You can more readily predict how long tanks with well-made blocks will last than when one or two of the blocks are poorly made. Poorly-made blocks will let the glass eat through, which means either making a hot repair; or the tank being put out.

MR. FISSE:—I find that a great many of the manufacturers want extremely large blocks. I believe it to be the consensus of opinion of the men making blocks and also some of those who use them, that a smaller block will give the best results.

For the making of a block that weighs in the neighborhood of twelve hundred pounds the average glass manufacturer will allow about four months. How is the manufacturer going to know whether that block is thoroughly dry on the inside? He can not tell. When a block with a wet core is burned, steam will be developed causing a fissure. The wet clay portion will part from that which is dry.

During the war we had some bad coal. Suddenly we obtained some good coal. The firemen did not know the difference, hence they shoveled in the same amount of this good coal as they had of the poor grade. In consequence the heat increased too rapidly and cracked the blocks. Those blocks were shipped and the customers made complaint about cracks.

After about a year they asked, "Can you not send us some more cracked blocks?" They had gotten very satisfactory service out of them.

MR. GRAFTON:—The answer to that is with the good grade of coal they burned the blocks all the way through. They got a splendid burn in the blocks, perhaps a better burn than usual.

I never made tank blocks with pug mills. That is the only way I have not made them.

The blocks Mr. Brown refers to must have been some I once heard of where the manufacturer placed wire in the blocks when they were made and then pulled the wires out to provide air spaces so the blocks would dry quickly.

Of all the blocks I have seen, I find the blocks are made best by making them by hand; that is, laying them in the same manner you would lay the bottom of the pot, starting with a layer about 1 inch thick and then laying each layer at right angles with the previous layer. After the block is built up the spare clay on the sides and ends is cut off with wires; drying and burning in the usual way.

I do not agree with Mr. Fisse that blocks are going to show a defect when they are burned on account of being large blocks. That is simply a question of proper burning and proper drying. I agree that you can not hasten the drying. The drying of twelve hundred pound blocks is entirely different from the drying of those weighing only 230 pounds.

Nearly all blocks will show some defects, small holes, drying cracks, etc., but I always felt safer in cutting blocks that had been laid by hand because we never found any defects to any great extent in such blocks.

You may wonder why we do not manufacture in this fashion. The answer simply is we can not afford to do so, and the glass man does not wish to pay more than the generally accepted market price for his blocks. In laying them by hand you have to use softer clay, hence they take longer to dry and you have to have five or six dollar a day men to do it, and not the old time two or three dollar men. It is simply on account of the expense that we do not make blocks by hand. I think, however, that better blocks would be made that way.

MR. ZOPFI:—I want to support Mr. Fisse in his argument that a large block can not be made successfully or burned successfully with the same material in comparison with a smaller block. You can make a smaller block much better, and you can burn that block to a high temperature more uniformly through it than you can a large block. The higher temperature you burn a block, the more serviceable it will prove in the furnace.

MR. FISSE:—I wish to correct Mr. Grafton's interpretation of my statement. A large block can be made without fissures. I know this to be true. The making of it, however, requires a much longer time. No

man should expect to make a block eighteen by thirty-six by forty-two in four months, because it can not be properly done.

Mr. Aurien:—Mr. Fisse is in the Clay Department of the Mississippi Glass Co., hence has an opportunity that other fire clay manufacturers do not have. When he wishes to make an experiment, they do it at the glass works. We are the goats. They have made a great number of large blocks which we have used in our 600-ton tank, with good results. These successes with large blocks are due, I believe, to the fact they have given time to thoroughly dry and burn them. If large blocks are given plenty of time to dry and burn, they will be good. The smaller block is easier to make however, and, as a rule, gives more economical results.

Mr. Dixon:—I am a builder, hence use blocks in the building of furnaces. It has always been my opinion that any lamination or crack or joint in a block is a defect. It is just the same as having too many horizontal joints in your tank wall. The alkali fumes will penetrate them and attack the block. That has always been my conception even when in the block business myself.

In contradiction to that, here is an odd thing. In the eighties, when they were just starting to build tanks in this country, Belgian engineers came here and built three window glass tanks. They shipped the blocks from Belgium. I never saw such a mass of clay in my life. They were as irregular as rough stones. They had stone masons chiseling those blocks into the sizes they wanted and there was not a single surface that was not full of holes, crevices and fissures.

These blocks came from where they had developed tank furnaces, and had used them for years. Afterwards, I went to the plants where they made these blocks. No one here would ever think of making a block like they made and still are making. They use moulds without bottom, just the frame. This they set on a board, and put a prop between the ceiling and the mould. They make the clay in a pit just as we do here. They roll a lump of the clay on a table by hand and then chuck it into the mold. They fill one corner and then the other corners one after another. The clay is just absolutely gobbed in. In this careless manner they fill the mold. They then find the clay has pushed out under the mould frame and has raised the frame at least an inch in spite of the prop or brace. They let the block stand for a couple of days until it stiffens, and then trim it with a long knife to make it nearly square and of proper dimensions. Yet their blocks seem to stand just as long as ours, and their furnaces give just as good service as ours.

We go to a lot of trouble in making blocks, that do not stand one day longer than theirs. Now, why is this?

This is a field worthy of investigation. Is it not natural to suppose with all the pains we take to make blocks, they should give better service?

I read the article by Mr. Loomis and I agree absolutely with what he said. I can not believe that a block full of cracks and lamination crevices can stand up as well as one that is put together in a good homogeneous, careful manner. And yet, why we do not get the service out of the better made blocks?

MR. HAUSER:—I would like to ask Mr. Loomis if he thinks a tank block can be too dense.

MR. LOOMIS:—Naturally a block can be too dense. If it is too dense it will crack when being heated up in the tank. If somebody gets an idea they can get a tank ready for production overnight, or in one or two days, the blocks are very apt to suffer, and in that case too dense a block is a very serious thing.

MR. WRIGHT:—Mr. Dixon made a statement which was somewhat surprising to me. Dr. Turner, after touring this country wrote a summary of his trip and I believe he stated that the American manufacturer was obtaining longer service from glass tanks than the English manufacturer. There seems to be a difference of opinion.

A MEMBER:—I believe Dr. Turner pointed out that almost universally in this country, perhaps window glass excepted, we use soda ash which is less corrosive than salt cake as used extensively in England.

MR. DIXON:—The three tanks mentioned actually did give a very long service. Of course, at that time the window glass manufacturers in this country used salt cake entirely. Through information received from other sources I have learned that we do not get any longer service from our tanks than they do over there, but we must remember that in England there is only one factory of any consequence making window glass. It is only recently they have copied American installation. Previous to the war they bought most of their plate glass and window glass from Belgium or in Germany; most of it in Germany.

I wish to mention one other thing in regard to blocks and the life of blocks. You will hear it said that if a bottle or jar manufacturer gets twelve months out of his tank he is mighty well satisfied. The decolorizer they are now using is worse in its effect on the blocks twice over than manganese. I can not tell you why, but it is true.

MR. AURIEN:—Mr. Dixon's discussion is vitally interesting to me. It is just recently that we began the use of selenium and cobalt decolorizer. When in place of eight pounds of manganese in a thousand-pound batch we use one ounce of selenium and cobalt decolorizer, one would hardly expect that it would affect the block.

I wish to refer again to longer life obtained from small blocks. We used to, on many occasions, run twelve, thirteen or fourteen months without a hot repair, and again we would run 10 or 11 months or stretch our run to 16 months, which we thought was a fairly good run. Now, we go twenty

and have gone as long as twenty-two months and a half without a hot repair. I can not tell the reason for this longer run now in comparison with former times, but I think it is because we build the tanks with straight-line joints and have broken the joints properly, and have used smaller blocks.

We make figured glass and wire glass. We fill 150 to 180 tons of material in 24 hours per 600-ton tank, not for one day or six days, but twelve, sixteen, eighteen and twenty months. We believe this larger capacity and longer service is due to straight, even joints and not using too big a block.

MR. HOSTETTER:—You use floaters?

MR. AURIEN:—We just use one set of floaters.

MR. HOSTETTER:—No bridge wall?

MR. AURIEN:—None.

MR. YUNG:—I would like to know what you mean by the life of a tank. Lots of people think the life of a tank means the time from the start of fire until the fire goes out; other people think it is from the time you have the glass melting until you make your hot repairs. In comparing the life of tanks, it seems to me mighty important to understand in what units you are talking.

I would like to substantiate some things said by Mr. Loomis. The largest burden of proving the value of sound blocks ought to be up to the block manufacturer rather than the glass manufacturer.

For quite a few years now, I have taken a photograph of the tank on the inside every time one goes out. This sort of a record has shown some very peculiar things. With blocks from the same shipment and supposedly of the same batch, you may have one block flux down to $^1/_2$ inch, while the others stand up to 6 or 8 inches. This, it looks to me, is a question of workmanship. I have seen other blocks standing in which holes and cracks would develop into which you could put your hand for 6 or 8 inches. Such irregular service, it seems to me is up to the block manufacturer to overcome, for if they were making uniform blocks the blocks would naturally wear uniformly.

MR. AURIEN:—We consider a run from the time we make our first cast. Probably the life of a run is due somewhat to the time taken to heat up the furnace. Suppose they direct me to start Number 4 furnace on the first of March. I will tell them that on April first we will make our first cast, and not before. We might shade that time a day or two, but roughly it is one month from the time we start a furnace to the day we make the first cast.

I have heard of instances where they will put fire to a furnace and in ten days after that make a cast. This I think is absolutely all wrong. You are doing an injustice to a tank block. There is no doubt about that. We take thirty days to heat the furnace to the casting condition because

we think it adds to the life of the furnace. If we get twenty-one months out of our blocks why can not those who use the same blocks?

MR. HOSTETTER:—Do you start with a full cullet melt?

MR. AURIEN:—Absolutely, we start off with a full cullet melt, and about 4 or 5 days before we are ready to cast we start to fill the batch.

MR. HOSTETTER:—A green tank?

MR. AURIEN:—Yes.

MR. DIXON:—Mr. Chairman, that very thing is the secret of his success. Naturally he fills every joint, lamination and everything else with molten glass so that all of the joints are sealed and glazed.

I am convinced there is no use making the blocks very thick. The walls of the first ones built in this country were 39 inches thick; think of it! Inside of a week or two eighteen, nineteen or twenty inches would slough off into the glass.

A concern using 8-inch blocks in a flint glass tank began to have trouble in about 8 months. Glass was coming through the joints. They complained that the tank did not run as long as it should. By inquiry in the factory I found that in nine days from the time that tank of 250 tons capacity was repaired with those eight-inch blocks, they had poured glass. Nine days after they lit the fire! I said, "Gentlemen, you need not tell me anything more." Think of it: They were pouring glass in nine days and then had the nerve to kick about the blocks.

MR. FISSE:—We shipped a concern almost a complete tank. We also shipped blocks to one of their nearby neighbors, also in the window glass industry. The blocks to both concerns were probably made out of the same batch of clay. The first one got about eight weeks out of his blocks (eighteen-inch wall) the other one got in the neighborhood of sixteen weeks. When those blocks that lasted only eight weeks were taken out, an arm could have been shoved into the fissures. The blocks were thoroughly permeated with glass.

Now, the whole proposition is this: they were not burning off the salt and water from their batch, but allowing them to saturate the blocks because the end of the fire was playing into the checkers. The other concern had the end of the fire in the combustion chamber and was burning off the salt water. It is the salt water that does more damage than anything else. You have to get rid of it.

MR. BROWN:—Mr. Aurien has stated he has run a 600-ton tank making wire glass, for over twenty-two months without any kind of repairs; I would like to ask if water coolers were used on the furnace.

MR. AURIEN:—I will say this, with absolute frankness, that the last twenty-two months run which we had on our big No. 4 tank, there was not as much as a brick or a handful of clay added to that furnace. After the first eleven or twelve months' run, we applied air in all spots that

showed a little bit red, and we maintained that air there until the furnace was out. Did I answer your question?

MR. BROWN:—Yes, that is very interesting. I think Mr. Dixon may be able to tell us if, when you put water on a tank to cool your blocks, your salt water is liable to run over to that cold side of your furnace and thus get one thing fighting against the other.

MR. AURIEN:—I may answer just that portion of your question. We have very little to contend with regarding salt water. Our batch is a 1000 pounds of sand, 370 pounds of limestone, 320 pounds soda ash, 58% dense and only five pounds—just imagine—only five pounds of salt cake. At times we would not necessarily need the salt cake; that is, not every day. About Thursday, Friday and Saturday of each week we add salt cake to get rid of our crust. You can imagine that our salt water is nothing.

There are very few manufacturers who would dare to wash out their checkers with 75-pound pressure water through a two and a half inch fire hose. We do not do this until after a five months' run. This is to allow sufficient time for the checker brick to become dense, *i. e.*, lose their porosity. If they are new and open and you apply the water onto new pores you would choke them all up, but after they are well burned—say after five or six months—they will then wash clean. We do this on Sunday morning and it only takes about thirty minutes to do it. We go through every checker once and then in a half hour we wash them again. Some of you are laughing, but it is a fact.

A MEMBER:—That is true.

MR. AURIEN:—We credit the longevity of our furnace to that one condition.

A MEMBER:—Did you ever take steam?

MR. AURUEN:—I believe you could use steam. Your checkers are hot, hence water answers the same purpose.

MR. DIXON:—That is not really new. I saw that done over thirty years ago. You can only do that though, if the accumulation is in the form of dust.

I know a man who actually built a tank of wood and melted glass. I know that to be an absolute fact.

MR. AURIEN:—I beg your pardon, gentlemen, but Mr. Dixon has gone me one better.

MR. DIXON:—He built double walls of planks, and between them he had water flowing, a water-cooling proposition that was unique. He actually melted glass in it. But here is where he fell down. He neglected to protect the plank at the glass level. If he had put an overhanging block on the wall above the plank wall to protect it, he would have gone on melting

glass. That was done in New Jersey. Then you talk about laminations in tank blocks.

MR. BROWN:—It has been my understanding that about the same batch is used for wire glass as is used for window glass. Since Mr. Aurien's batch contains practically no salt cake it would be expected to have less corrosive action on tank blocks than does a window glass batch containing considerable salt cake.

MR. DIXON:—Do you not know that window glass people use salt cake because it gives a lustre and brilliancy that you can not get from soda?

MR. BROWN:—Here is a man getting along without it.

MR. DIXON:—Of course, there are lots of them doing without it, but he is making wire glass. He is not making the glass you are making. They use the salt cake because it gives window glass a brilliancy and lustre that they do not get from soda. Soda ash glass in a window will finally get dim and will not retain the lustre and brilliancy as will the salt cake glass.

DISCUSSION[1] ON "THE HANDLING, STORING AND SETTING OF GLASS POTS"[2]

MR. DIXON:—Mr. Forsyth failed to touch on one important feature from a furnace builder's standpoint, and that is the care of the bench of a furnace. We have had any number of cases where furnaces have lasted without repairs from five to six years; in one case seven years. We have had other cases where they have gone out in one or two years and they wonder why they fail to get the same service. The answer is that every time they set a pot they do not fill the gulleys that they find on the bench of their furnace. Those gulleys should be filled so that the glass will not continue flowing through that same channel and eventually eat its way to the bottom part of the furnace. Those who take the precaution every time they set a pot to keep their bench in repair are the ones that get long life and service from their furnace, and that is a mighty important feature, for the rebuilding of a furnace is a very expensive proposition.

There is another matter in setting pots; every pot has a concave bottom. No matter how carefully you spread sand on the bench with a rake or any other kind of tool, it is impossible to get an even bearing on the bottom of the pot, which has to carry the entire weight of the glass, unless the pot is worked back and forth two or three times until it absolutely beds itself in the sand underneath. This gives the center of the bottom the same support as it has around the outside and prevents the bottom from dropping out.

There are some very funny things that happen in the handling of pots.

[1] Discussed St. Louis Meeting, Feb. 28, 1922.

[2] Forsyth and Clark, *Jour. Am. Ceram. Soc.*, 5, 146–50 (1922).

As I remember, years ago when we were in the pot business, we had a complaint from customers to whom we had shipped carload after carload of pots. They complained that they all either broke in the bottom or cracked around the wall at the bottom. It became so serious that we went there with a carload of pots to observe how they handled them.

They had a pot carriage and they carried them from the car, and everything of that sort. Their pot carriage had a small swivel wheel in the center that enabled them to turn around almost within the circumference of the pot, which was very convenient, but to do this turning they took two pieces of about one and one-half inch hemp rope and laid them crosswise over the carriage which, when the pot rested on them, gave them four points to pull on. Now where those ropes crossed right underneath the pot there was a hump that sustained the entire weight of the pot and when they pulled the pot over to the place where it was to be stored the whole pot was riding right on the center of the bottom which is the weakest part of the pot. That was the trouble and the problem was solved and they only found it out after they had ruined three of four carloads of pots.

MR. FORSYTH:—I would like to ask Mr. Dixon if the channels he means are those from the back of the pot down to the slag holes?

MR. DIXON:—Yes.

MR. FORSYTH:—That, I will admit is not touched upon at all in our paper, but the matter of getting an even cushion under the pot was implied by the word "settled" but not discussed in detail.

A MEMBER:—I would like to ask Mr. Forsyth, if he ever had any experience in raising the pot off of the bench, that is, elevating the pot?

We had one glass manufacturer send us specifications to make a pot with channels on the bottom, if I remember correctly, about four stilts or three stilts on either side, radiating from the center and about ten inches high. When the pot was set in the furnace this would allow a passage of heat underneath the pot. I presume the object was good melting.

It has always been customary to set pots on the bench of the furnace. The Sneath Glass Co., of Hartford City, Ind., had a fire clay bench in a furnace that I know was in operation for 16 years. They were very careful when they removed a pot to fill up all the crevices, as Mr. Dixon would put it, and it looked foolish the amount of time they would take in leveling off that bench. The bench was always carefully prepared for the pot and I noticed that they always scraped out the middle of the sand before the pot was set back and then it was shifted around as Mr. Dixon described in order to settle it.

Now we all know that with existing conditions the fire can not get at the bottom of the pot. The general practice throughout the country is that the temperature of the pot arch is not brought up to the temperature of the furnace. In many cases it is as low as 200°F, below the temperature

of the furnace. Therefore, the pot will not be burned as hard in the pot arch as it will be in the furnace and if it is set with the bottom on the bench it is certain the bottom will not be burned as hard as the rest of the pot. I remember our customer showed me the pots that he was using and I remarked that he would surely have to set them on the bench and he replied, "No. It may not be done elsewhere but we are elevating them and getting successful results."

MR. FORSYTH:—I will have to confess that practically all of my experience with pots has been at one plant, and I believe I can safely say we have an exceptional man in charge there. It is a hobby with him to take care of his furnace. We have one furnace that only needs a fire in it to start it up after seven years of operation. I think Mr. Dixon is familiar with the furnace.

We have tried putting the pots into the furnace on jack bricks and then taking down the breast wall and letting them down again. Our experience has been with all such tests that an assertion on a few tests is unreliable. We prefer to make a statement only after a considerable quantity have been so tested. As we only tested a few pots in this particular manner the results were not considered conclusive. As I remember, we attained good results but nothing extraordinary.

DISCUSSION[1] ON "OPERATION OF LEERS[2]

MR. PAYNE:—Mr. Adams objected to the phrase that Mr. Frazier used when he spoke about "the temperature at which the strain is introduced," and claims that there is no strain in the glass until it is at a low temperature. At our factory we use a pressure of five thousand pounds per square inch in the making of tumblers. With this pressed ware we have much more trouble in getting satisfactory annealing than with articles of the same size and weight made with low pressure. On the Owens machine, a pressure of about 18 lbs. per sq. inch, the annealing is much easier than with tumblers. We feel very sure that strain is introduced when the plastic glass is compressed at a temperature above the annealing region. That is, we think strain is present before the temperature of the glass has been lowered to 1000–900°F. As I understand Mr. Adams, it is his belief that there is no strain until these temperatures are reached.

MR. HOSTETTER:—You have a higher initial strain, in other words, than you do in using lower pressure.

MR. PAYNE:—That is our opinion. We press from five to eight thousand pounds per square inch.

[1] Frazier, *Jour. Amer. Ceram. Soc.*, **5**, 37–42 (1922). Adams, *Ibid.*

[2] St. Louis Meeting, Feb. 28, 1922.

MR. HOSTETTER:—May I ask what the difference in thickness of the ware is?

MR. PAYNE:—About the same in either case. That is, all the way from a half inch at the bottom to an eighth inch in the tumblers, and in some of the bottles we make, it would be almost that thick in the bottom.

MR. DIXON:—Isn't it true, you get a strain in the initial process of pressing the glass from the mere contact of the iron?

MR. PAYNE:—It was our opinion we were getting some due to the enormous pressure.

MR. DIXON:—Leave out the pressure—the mere contact of the iron I mean.

MR. PAYNE:—That is probably so. That is often shown by minute cracks that are visible.

MR. HOSTETTER:—It is the consensus of opinion, varying in particulars of course, that there is a difference between what we call chilling action and the strain introduced mechanically in the blowing. The subject is one that may be investigated in great detail. There is here, certainly, a field for investigation.

A MEMBER:—I heard a little incident that may have some bearing on the question of pressing of spectacle lens where a quick, hard action was used instead of a slow, squeezing action. The lens had more tendency to show cracks on the surface due to quick cooling cracks, which the slow squeezing action eliminated.

DISCUSSION[1] ON "A SMALL GLASS TANK"

MR. BELLAMY:—Mr. Chairman and gentlemen, I feel that I should apologize for this paper. After I announced my intention of writing it, I got a letter from Dr. Tillotson asking me to send the paper by return mail, and it was written rather hurriedly. There is one thing you should bear in mind; that we are making glass in much the same manner that a large manufacturer would run his brass melting establishment, and there are many things that come up in our case that do not apply to a large scale production. However, there are some points that will come out in this short paper that may be of interest. In the meeting this morning was discussed the use of blue-water gas for glass melting. We have used blue-water gas for four or five years in melting small quantities of glass, and we have never noticed any serious defects in the glass. However, there is a point that may come up in using it in very large quantities, and that is the formation of iron carbonyl. Blue-water gas passing through the mains comes in contact with the iron and small quantities of iron carbonyl are formed. This product is an unstable gas decomposing, when heated, into carbon monoxide and iron oxide which would of course affect the color of the glass.

[1] Bellamy, *Jour. Amer. Ceram. Soc.*, 5, 157–60 (1922). Glass Division, St. Louis Meeting, Feb. 28, 1922.

THE CHAIRMAN:—Mr. Bellamy's paper is open for discussion.

MR. WRIGHT:—Mr. Bellamy spoke of using zirkite brick in the crown. He first spoke of silica brick and their tendency to spall. The zirkite brick wasn't used then for its higher heat resistance—higher effectiveness.

MR. BELLAMY:—It was used principally to withstand the severe action on the arch of the flames playing directly on it. Heat resistance also needed for this arch is insulated with a platen of fire brick and about six inches of Sil-O-Cel, so that the top of the crown is not over 100° Centigrade.

MR. HOSTETTER:—In ordinary performance, we find above the middle line it attacks fire clay very rapidly, and it doesn't attack the silica brick. Can you tell something about the attack any the zirkite brick?

MR. BELLAMY:—There is scarcely no action on it.

A MEMBER:—You mean to say you had it insulated?

MR. BELLAMY:—Yes, $4^1/_2$ inches of zircon brick with a course of fire brick laid flat, and then possibly five or six inches of Sil-O-Cel above.

MR. DIXON:—How much glass did the tank hold?

MR. BELLAMY:—About five or six hundred pounds.

MR. DIXON:—How long did you operate it?

MR. BELLAMY:—About a year.

MR. DIXON:—Is that the same tank that is in operation now?

MR. BELLAMY:—Yes.

MR. DIXON:—What kind of glass did you have?

MR. BELLAMY:—High lead glass.

MR. DIXON:—Did you say the capacity of the furnace was five or six hundred pounds?

MR. BELLAMY:—Yes.

MR. DIXON:—Is it daily, intermittent or continual? You put it in the night before? Daily melting?

MR. BELLAMY:—Yes, sir, daily melting.

MR. DIXON:—Have you no record of the temperature?

MR. BELLAMY:—Yes.

MR. DIXON:—What was it?

MR. BELLAMY:—Around 2400°F.

MR. DIXON:—And what did you say the crown was built of?

MR. BELLAMY:—Zirconium silicate. Don't confuse that with zirconium oxide.

MR. DIXON:—And this was insulated?

MR. BELLAMY:—Yes, sir.

MR. WATSON:—I would like to ask if this material is zirconium silicate.

MR. BELLAMY:—Yes, I want to emphasize that. It is not zirconium oxide, but zirconium silicate. It is a brick made by the Carborundum Company.

MR. WATSON:—That brick is of zirconium silicate.

MR. DIXON:—Where is this concern located?

MR. BELLAMY:—Chicago.

MR. DIXON:—May we come up and see it?

MR. BELLAMY:—I am not in a position to say that you can come to see it.

MR. DIXON:—Well, you have made some statements that are very startling and I would like to see it, and would like to make some tests on it.

MR. BELLAMY:—You might send in a request to the Company. I am sure it would be favorably considered.

THE CHAIRMAN:—Is there any particular trade name for these bricks as put out by the Carborundum Company?

MR. BELLAMY:—Zirconium silicate brick.

MR. BROWN:—In four or five or six hundred pound furnaces, you have an entirely different proposition than the most of us have to deal with.

MR. BELLAMY:—The arch is the hottest part of the furnace for the flames come from the burner and impinge on the arch where you get perfect combustion.

MR. BROWN:—What size is the cap?

MR. BELLAMY:—It is about 2 feet across and about 45 inches long.

MR. WRIGHT:—I believe we are all acquainted with the fact that some of the mineral companies are recommending zirkite brick for superrefractories and for crowns of small tanks and especially where high temperatures are obtained. We see their advertisements. I think this is one of the first statements we have had though from actual use and service. It may open up something of very much interest to everyone here.

MR. WATSON:—As I understand the gentleman he is not using zirkite brick but zirconium silicate, which is not the oxide, but the silicate of zirconium.

MR. BELLAMY:—Yes, it is not the oxide.

MR. WRIGHT:—Zirkite brick is one you can buy in three or four different grades. The cheapest grade contains nearly 50% of SiO_2 which is commercially speaking zirconium silicate. They put that out in goods commercially called zirkite brick.

MR. BELLAMY:—The zirconium silicate is handled by the Buckman-Pritchard Company and the brick by the Carborundum Company. They mix a little clay in with the powdered zirconium silicate to produce a cement in which to lay the brick. This arch has produced remarkable results in that there has never been a case of a piece of a brick spalling off. As the zirconium silicate does not harden, the arch has been taken apart brick by brick and set up again which is very desirable as the brick cost a dollar apiece.

MR. DIXON:—Do you know any reason why a large furnace would not do as well as a small crown mixture?

MR. BELLAMY:—No sir.

MR. WRIGHT:—A dollar a brick?

MR. DIXON:—Yes.

MR. WRIGHT:—Zirkite brick would have a specific gravity of 4.5, and silica brick is in the neighborhood of 2. The zirkite crown would be over two times as heavy as the silica brick crown.

MR. BROWN:—Did you insulate this cap?

MR. BELLAMY:—No, I didn't insulate the silica brick.

MR. BROWN:—It fell down?

MR. BELLAMY:—It cracked when the flames impinged upon it.

THE CHAIRMAN:—I would like very much, since this subject has been opened up, to see if we can get one of the Carborundum Co. representatives to give information about this super-refractory.

MR. ONAN:—Mr. Bellamy has read a paper, I understand, on the work he has done with zirconium brick. The material used is not zirconium oxide but natural zirconium silicate. Very little work has been done by anyone other than ourselves on this particular material, and it is still in the laboratory. We are, however, producing some commercial size brick, and we are having some pretty good luck. In the glass tank furnace that Mr. Bellamy built it gave some remarkable service, and we have hope at an early date of trying it out on a larger furnace. Until that time arrives, we can not say just what it will do, or how it will do.

The material we are using is a distinct product. It is a natural combination you can not make up, and its action is not at all like that of zirconium oxide; very little spalling as with silica brick, and it has a very low heat conductivity quite contrary to our other refractories. We are in a position to furnish samples of this material to anybody who wants to look them over and give them a test, but as far as the product being perfected, or putting them on the market, it will be several months before we can do it. If there are any specific facts anybody wants to know, and I can tell them, if they will write to us, we will be very glad to go over the whole proposition.

THE CHAIRMAN:—Have any of you questions you would like to ask the gentleman?

MR. WATSON:—I might state that in the Thompson Laboratory we have made some tests on zirconium oxide and zirconium silicate, and we find there is a vast difference in the two. While the tests are only in their infancy, we have enough data to know there is a considerable difference. One particular difference is the high resistance of the zirconium silicate over the oxide, also the small heating conductivity.

THE CHAIRMAN:—Any further remarks? I certainly would be interested in getting a sample of the refractory. I imagine those present will take advantage of your offer to send samples. I certainly thank you for giving us this information about refractories; it is of great interest to all of us.

ACTIVITIES OF THE SOCIETY

BASEBALL SEASON ENDS WITH BIG SPURT

Manager Bowman Well Pleased with Team's Work

We had a hunch in the Secretary's office that September would see the dust flying on the diamond, and on the fourteenth of the month the forty-second runner slid across the home-plate, bringing the score six runs higher than any other month except the time of the Annual Meeting. Eleven of these, as Corporation Members, made home runs. This is something to tell the world, especially of a month containing ten dog days so doggone hot it was hard to sit at a desk and hold a pen in a perspiring hand long enough to sign on the dratted line.

The batting average follows:

	Personal	Corporation		Personal	Corporation
Chas. F. Binns	2		D. A. Moulton	1	
J. W. Cruikshank	2		Frank G. Roberts	1	
E. W. Dailey	1		Abel Hansen		1
W. W. Wilkins	1		H. F. Staley		1
Ellsworth Ogden		1	Alan G. Wikoff	1	
Chas. Laird	1		Herbert Goodwin	1	
A. M. Kohler	1		J. S. Herzog	1	
Geo. W. Shoemaker		1	J. L. Child	1	
E. P. Poste		1	Charles Brian		1
F. W. Butterworth	1		Gordon Klein		1
Joseph Johnson	1		Werner Malsch	1	
Fred T. Heath	1		H. H. Sortwell	1	
O. O. Bowman, 2nd		1	Donald Hagar	1	
Victor Barth	1		R. R. Danielson	1	
			Office	9	3

Total—31 Personal, 11 Corporation

The net increase for the first eight months of this year is:

	Personal	Corporation	Total
September 14, 1922	1539	199	1738
January 1, 1922	1350	139	1489
	189	60	249

The gross increase in membership by periods since June 1921 is:

	Personal	Corporation	Total
June to September 1921	41	11	52
September to December	18	2	20
December to February 1922	136	21	157
February to May	81	10	91
May	13	13	26
June	13	5	18
July	25	11	36
August	20	5	25
September	31	11	42
	378	89	467
Loss	82	5	87
Net increase	296	84	380

The football season is opening. Last month the goal was set at 200 personal and 100 corporation members.

The referee's whistle has blown. Three months to play, 169 personals, 89 corporations to go. Snap into it, men!

New Members Received from August 11 to September 14

ASSOCIATE

Berry, Sydney G., Gifford & Bull, 141 Broadway, New York City, Patent Attorney.
Blake, Edwin M., Drawer A, Pratt Sta., Brooklyn, N. Y.
Campbell, A. M., P. O. Box 30, Perth, Ont., Canada, Mining Geologist.
Chivacheff, Louie H., Cornwall-on-Hudson, New York, Instructor Drawing and Manual Training.
Christie, Charles H., 602 N. McKean St., Butler Pa., Standard Plate Glass Company.
Coon, Darius A., Storrington Feldspar Co., Elgin, Ont., Canada, President.
Dorsey, Frank M., Nela Park, Cleveland, Ohio, Consulting Engineer, G. E. Co.
Doughty, I. N., 223 Kentucky Ave., Danville, Ill., Gen. Supt., Western Brick Company.
Elliott, Harry C., Cascade China Co., Portland, Ore., Pres. and Treas.
Gandette, Charles A., 661 New Willow St., Trenton, N. J., Trenton Potteries Co. Laboratory.
Gifford, Maurice S., 142 Osborne Ave., Libertyville, Ill., Chief Chemist, Chicago Hardware Foundry Co., North Chicago, Ill.
Green, John R., 319 S. Maryland, Mason City, Ia., Ceramic Engineer, North Iowa Brick & Tile Co.
Greer, W. Russell, 1938 Linden Ave., Baltimore, Md., Porcelain Enamel & Mfg. Co.
Ingler, William J., Holophane Glass Co., Inc., Newark, Ohio, Asst. Supt.
Jarmuth, Otto C., 9120 Commercial Ave., Chicago, Illinois, Art Director.
King, Robert Maynard, Box 103, Sta. A., Columbus, O., Student, O. S. U.
Kleymeyer, Henry C., Standard Brick Mfg. Co., Evansville, Ind., Gen. Mgr.
Lambert, Frank B., Illinois Brick Co., Chicago, Ill., Gen. Supt.
Landers, William H., 4 West 43d St., New York City, Consulting Engineer.
Marr, William H., c/o Canadian Libbey-Owens Sheet Glass Co., Hamilton, Ont., Canada, Supt.
Moller, Knud J. Chr., 4956 McPherson Ave., St. Louis, Mo., Chem. Engineer.
Owen, Frank E., The Findlay Electric Porcelain Co., Findlay, O., Sec. and Mgr.
Schroeder, Fred W., U. S. Bureau of Mines, Seattle, Wash.
Shearer, Walter L., 3044 Dent Place, N. W., Washington, D. C., U. S. Bureau of Standards.
Smith, Stanton G., Box 94, Auburn, Me., Maine Feldspar Co., Mgr.
Smith, Walter C., 654 St. Nicholas Ave., New York City, Sales Mgr., N. J. Pulverizing Company.
Taylor, Mark A., Terminal Bldg., Ft. Dodge, Iowa, Ceramic Eng., Vincent Clay Products Company.
Thompson, J. S., The Excelsior Dental Mfg. Co., Grace Road, Aintree, Liverpool, England, Managing Director.
Walker, Thomas C., Mosaic Tile Co., Plant No. 2, Matawan, N. J., Ceramic Engineer.
Winton, Lewis B., Great Barrington, Mass., Gen. Mgr., Stanley Insulating Co.
Zimmer, Daniel B., 1381 Sedgwick Ave., New York City, Treasurer, Vitreous Enameling & Stamping Co., Inc.

CORPORATION

Auld Co., D. L., 5th St. and 5th Ave., Columbus, Ohio.
American Stove Company, 2001 S. Kingshighway, St. Louis, Mo.

The Clay Products Co., Brazil, Indiana.
Fords Porcelain Works, Perth Amboy, N. J.
Metal & Thermit Corp., 120 Broadway, New York City.
N. C. Geological & Economic Survey, Chapel Hill, N. C.
Paper Makers Importing Co., Inc., 640 N. 13th St., Easton, Pa.
The Patterson Foundry & Machine Co., East Liverpool, Ohio.
Springfield Paving Brick Co., Box 403, Springfield, Ill.
The Trenton Potteries Co., Trenton, New Jersey.
The Vitreous Enameling Company, 71st and Grant Ave., Cleveland, Ohio.

Who's Where in the American Ceramic Society?

T. S. Curtis, president and general manager of the Vitrefrax Company, has notified the office of a change of address from North Rugby Avenue to 534 S. Seville Street, Huntington Park, Los Angeles, Cal.

Cedric L. Rennieburgh has recently taken a position with the A. C. Spark Plug Company, at Flint, Mich. Mr. Rennieburgh was formerly with the American Encaustic Tiling Company, Zanesville, Ohio.

W. W. Ittner has moved from Pershing Avenue to 2107 Park Avenue, St. Louis, Mo. His connection with the General Clay Products Corporation as treasurer continues.

George W. Hasslacher, of the Roessler & Hasslacher Chemical Company, sailed for Germany on September 16. He will be located for some time at the Deutsche Gold and Silber Scheideanstalt, Frankfurt, a./M.

H. M. Reed has moved from Pittsburgh to 106 Dixon Avenue, Ben Avon, Pa.

Ira E. Sproat took charge, on September first, of the Ceramic department of the R. T. Vanderbilt Company, New York City.

Waller Crow, formerly secretary-treasurer of the Schaffer Engineering and Equipment Company, Pittsburgh, Pa., is now president of his own company, Waller Crow, Inc., Chicago, Ill.

J. Alfred Dennis, of the Golding Sons Company, has been made superintendent of the Golding-Keene Company, Keene, N. H.

F. P. Hall, of the Bureau of Standards, Washington, has changed his residence from Crittenden Street to 630 Webster Avenue.

J. Ellis Harvey, general manager of the Centre Brick and Clay Company, is now located at Ridgway, Pa.

Arthur L. Koch gives as his new address, 1748 Wellesley Avenue, St. Paul, Minn.

J. B. Owens, of the Empire Floor and Wall Tile Company, has moved from Zanesville, Ohio, to 137 West 25th St., New York City.

R. R. Shively has just been appointed chief technologist for B. F. Drakenfeld & Company, New York City, where he will be technical advisor to the officers of the company. For eleven years Dr. Shively has served as industrial fellow at Mellon Institute, where he has specialized on glass and glass-making materials.

M. G. Babcock, formerly of the Pittsburgh office of the Laclede-Christy Clay Products Company, has been transferred to their Rochester plant, to handle the sales of all glasshouse refractories manufactured there. Mr. Babcock's territory will comprise all pot glass manufacturers in the United States and Canada.

T. M. McVey, recently of the Lacon Clay and Coal Company, Lacon, Illinois, has been appointed instructor in the Ceramics department at the University of Illinois.

T. W. Garve, recently located at Watsontown, Pa., has returned to Columbus, and may be found at 47 North 20th Street.

Herman Coors, who severed his connection with the Coors Porcelain Company some time ago, is now established at 3768 Dalton Avenue, Los Angeles, Cal.

A. Malinovszky, formerly with the U. S. Smelting Furnace Company, Belleville, Illinois, has gone to Long Beach, California.

H. P. Reinecker, formerly with the Bureau of Standards, Washington, has accepted a position with the Pacific Enameling and Manufacturing Company, Oakland, Cal.

Robert F. Sherwood, has left the Muncie Clay Products Co., Muncie, Ind., and has taken a position with Pass & Seymour, Inc., at Syracuse, N. Y.

Chester Treischel has been transferred by the General Electric Company to the Pittsfield works, Pittsfield, Mass.

Carl G. Zwerner, who has been with the Northern Clay Company, Auburn, Wash., for some time, has returned to Columbus, where his address is 58 West Tenth Avenue.

Addresses Unknown

Any information as to the whereabouts of the following members of the Society will be gratefully received by the Secretary's office. Mail has been returned from the addresses given.

Baker, G. V., Penn Feldspar Co., Philadelphia, Pa.
Bickel, Earl A., Postville Clay Products Co., Postville, Iowa.
Bramlett, Mrs. J. T., Enid, Miss.
Brett, R. C., Southern Clay Mfg. Co., North Birmingham, Ala.
Buckner, O. S., 44 Wellington St., Worcester, Mass.

Callaghan, J. P., c/o Teaque Hotel, Montgomery, Ala.
Curran, Hugh, Bakersfield Sandstone Brick Co., Bakersfield, Cal.

Dolley, Charles S., Keramoid Mfg. Co., Fort Madison, Iowa.

Fiske, J. Parker B., Arena Bldg., New York City.

Greenwood, John L., Lehigh Sewer Pipe and Tile Co., Lehigh, Iowa.

Hall, Herman A., McLain Fire Brick Co., Vanport, Pa.
Henshaw, S. B., Libbey-Owens Sheet Glass Co., Charleston, W. Va.

Knote, J. M., Mines Dept., L. S. Corp., Sault St. Marie, Ontario.

Meissner, Max, Sprague Canning Machine Co., Hoopeston, Ill.
Miller, J. J., Mellon Institute, Pittsburgh, Pa.
Mitchell, Leon W., Rock Island Stove Co., Rock Island, Ill.
Mulholland, V., 41 Arch St., Hartford, Conn.

Nagle, J. A., 196 Oak St., Columbus, Ohio.

Pendrup, W., Coonley Mfg. Co., Cicero, Ill.
Pire, Mrs. Ward L., 1745 East 116th Place, Cleveland, Ohio.
Pulsifer, H. M., Geo. H. Holb & Co., Chicago, Ill.

Ragland, N. A., Alberhill Clay and Coal Co., Los Angeles, Cal.
Reid, W. H., 10 Stanley Place, Yonkers, N. Y.

Stewart, John G., 530 Union Trust Bldg., Cincinnati, Ohio.

Tefft, T. D., Hamilton, Ont.
Trace, A. R., National Fire Proofing Co., Hobart, Ind.

Vodick, William J., 1733 Lake Ave., Wilmette, Ill.

Yamamoto, Tamesburo, Yamatame Glass Mfg. Co., Osaka, Japan.

Exhibit of Ceramic Wares

TWENTY-FIFTH ANNIVERSARY CONVENTION, FEB. 12–17, 1923

The Art Division, under the chairmanship of Frederic H. Rhead, is planning an exhibit for this convention. Plans have not as yet been fully formulated but the occasion suggests the scope and character of the exhibit desired.

The several Divisions will be asked to coöperate in making an exhibit illustrative of the twenty-five years of development in their respective industrial groups. Ample space conveniently located has been secured in the hotel.

The American Ceramic Society at the Chemical Show

BY ALAN G. WIKOFF

The American Ceramic Society was well represented at the Eighth National Chemical Exposition the week of September 11. At the opening meeting President F. H. Riddle[1] gave an address; Friday, September 15, was "Ceramic Day" when a program of fifteen papers was presented before an audience of 150. Two booths were maintained throughout the week as headquarters for the members of the Society.

Mr. Riddle's talk on "The American Ceramic Industry" was an excellent presentation of a subject which is gaining daily in importance to the world. His definition of the term "ceramic" was careful and his classification of the ceramic branches concise and of vital interest. The paper discussed further the following points:

1. Standards for Purchase
2. Industries Described
   - (*a*) Hollow-ware
   - (*b*) Architectural Terra Cotta and Tile
   - (*c*) Brick
   - (*d*) Glass
   - (*e*) Enameled Steel and Iron
   - (*f*) Abrasives
   - (*g*) Refractories, Silica, Aluminum, Magnesia, Etc.
3. Progress of Ceramic Work during the War
   - (*a*) Development of Better Refractories
   - (*b*) Enameled Iron
   - (*c*) Chemical Stoneware
   - (*d*) Graphite Crucible
4. Relation between Ceramic Interests
5. The American Ceramic Society

Ceramic Day formed a fitting climax to the technical programs held in conjunction with the Eighth National Exposition of the Chemical Industries. At the afternoon session papers of a high order of merit were presented on a variety of ceramic subjects. The meeting was exceptionally well attended and those in the audience who were not members of the American Ceramic Society took away with them a clearer conception of the importance and magnitude of the ceramic industry. They realized, perhaps for the first time, the many points at which this industry touched their daily lives. For the members there was much of real technical value, and the assimilation of important information was facilitated by carefully prepared lantern slides and ingenious models in several instances.

[1] This paper will be published in full in this *Journal*, January, 1923.

The following papers were given:

W. H. Gaylord, Jr. (Quigley Furnace Specialties Co.), "High Temperature Cements."

E. S. Hirschberg (Ding's Magnetic Separator Co.), "Application of Magnetic Separator in Ceramic Industries."

G. D. Dickey (Industrial Filtration Corporation), "Preparation of Clays and Minerals for Ceramic Purposes."

Eric Turner (Trenton Flint and Spar Co.), "Apparatus for Quickly Determining Fineness of Grind."

W. H. Landers, George M. Darby, O. O. Bowman, 2nd, August Staudt, C. R. Moore, C. M. Franzheim, "Feldspar Colloquium."

H. C. Arnold, "Manufacture of Gray Enameled Ware."

A. E. Williams, "Whiting for Ceramic Uses."

C. B. Chapman (Chapman Engineering Co.), "Gas Producers for Glass Works."

Paul E. Cox, "Witchery of Glazes."

Conrad Dressler, "Architectural Faience and Its Artistic Possibilities."

Frederic H. Rhead, "Organization of a Decorative Ceramic Research Department: Financial and Manufacturing Considerations."

Earle N. McGee (Semet-Solvay Co.), "Testing Refractories."

Charles E. Kraus (Johns-Manville Inc.), "High Temperature Cements."

F. P. Nickerson (W. S. Tyler Co.), "Sieve Testing of Ceramic Materials."

H. F. Kleinfeldt (Abbé Engineering Co.), "The Grinding of Ceramic Materials."

In the evening, the Society contributed two important papers to the symposium on Standardization arranged by the New York Section of the American Chemical Society.

1. Ross C. Purdy discussed some of the problems encountered in attempting to standardize fire clays and refractories.

2. Emerson P. Poste presented a series of lantern slides illustrating what is being accomplished toward the standardization of enameled wares for chemical purposes.

NOTES AND NEWS

Calendar of Conventions

The Silver Jubilee of the AMERICAN CERAMIC SOCIETY will be celebrated at the next Annual Meeting which is noted on this list. Watch for the announcements as they appear in other portions of this *Journal*.

American Mining Congress—Cleveland, Ohio, October 9–17, 1922.

Society of Industrial Engineers—New York City, October 18, 1922.

National Association of Commercial Organization Secretaries—Chicago, Ill., October 23–25, 1922.

National Society for Vocational Education—Detroit, Mich., November 30–December 2, 1922.

Dental Manufacturers Club—St. Louis, Mo., November 20, 1922.

Dental Exhibit of the Dental Manufacturers Club—St. Louis, Mo., November 21–24, 1922.

National Exposition of Power and Mechanical Engineering—New York City, December 7–13, 1922.

Mining and Metallurgical Society of America—New York City, December 7–13, 1922.

American Malleable Castings Association—Cleveland, Ohio, January 10, 1923.

National Jewelers Board of Trade—New York City, January 18, 1923.

Canadian National Clay Products Association and Western Ontario Clay Workers Association—Hamilton, Ont., January 24–26, 1923.
American Concrete Institute—Detroit, Mich., February, 1923.
National Association Builders Board of Control—Des Moines, Iowa, February, 1923.
AMERICAN CERAMIC SOCIETY—Pittsburgh, Penna., February 12–17, 1923.
National Gas Association of America—Louisville, Ky., Spring, 1923.
American Institute of Mining and Metallurgical Engineers—New York City, February 19–22, 1923.
National Association of Stove Manufacturers—Richmond, Va., May 9–10, 1923.
American Association of Museums—Charleston, S. C., May, 1923.

I STEEL FOUNDRIES COOPERATE IN JOINT RESEARCH
II COORDINATING FOUNDRY CONTROL
III SCIENTIFIC INVESTIGATIONS LEAD TO BETTER PRODUCT
IV IDEAS FREELY INTERCHANGED

These headlines appeared in a recent issue of *The Iron Trade Review*.[1] The stories told were of the coöperative research and plant control in which five steel foundries are engaged under the direction of Major R. A. Bull. Electric Steel Co., Chicago; Fort Pitt Steel Coasting Co., McKeesport, Pa.; Michigan Steel Casting Co., Detroit; Sivger Steel Casting Co., Milwaukee are thus coöperating.

With improved quality as the goal and diligent teamwork as the means to that end group research has proved its worth to associated manufacturers producing a common product. No more trying conditions could be imagined for testing the worth of coöperative research than the depression which has marked almost the entire period of the association of five progressive steel casting manufacturers in the Electric Steel Founders' Research Group. While some large manufacturing interests possessed of practically unlimited means have cut their research appropriations to the bone, have lightened their overhead by reducing and even in certain cases dismissing entire research staffs, abandoning projects and sacrificing results of years of endeavor, this small body of steel casting producers has held steadily to its purpose, sustained by its faith in the ultimate outcome. Consequently, its members, emerge into the period of keen competition at hand well equipped in shop methods, quality of product, and organization morale.

This statement may seem exaggerated to those who are not familiar with the breadth and character of the work being done by this group. It will be difficult to understand without a knowledge of the accomplishments of the plan how, for example, the organization morale of the individual members could be appreciably benefitted. However, this assertion is fully supported by a familiarity with the facts which have been established. The idea of group research and coöperative effort between five manufacturers making a similar class of steel castings had its inception early in 1920, when in response to a call by C. R. Messinger, of the Sivyer Steel Casting Co., a meeting was held in Pittsburgh, Feb. 25, 1920. Here a plan was outlined whereby technical problems could be solved by the combined efforts of the foundries associated.

Obviously, the basic requirements of an association of this character were implicit confidence between the members and the unselfish interchange of data. How well the idea has been carried out will be evident from the results attained. Improvement in quality of product, the underlying purpose in forming the group, required the supervising control of a recognized expert in steel foundry practice. The company secured the exclusive services of Maj. R. A. Bull, who had long been a dominant figure in the industry through his association with the Duquesne Steel Foundry Co., as Vice President

[1] D. M. Avey, page 1472. *The Iron Trade Review*, May 25, 1922.

and General Manager, and previously with the Chicago Steel Foundry Co., the Commonwealth Steel Co., and the American Steel Foundries. Major Bull's activity in the American Foundrymen's Association, of which he was president in 1915 and 1916, had further fitted him for the task of organizing and correlating the staffs of the various members of the group. The wisdom of his selection is attested by the ready response and hearty coöperation observed among the superintendents, foremen and workmen in their attitude toward the research director, as Major Bull is termed.

Recognizing, from the first, the dual nature of the problems to be encountered, a working organization within the group was formed. This had two controlling committees, the general committee, having the decision on questions of policy, finance, and cost; and the technical committee, dealing with operating problems. At present these committees are made up as follows:

GENERAL COMMITTEE

Chairman, C. R. Messinger, vice president and general manager, Sivyer Steel Casting Co.
R. F. Flinterman, president, Michigan Steel Casting Co.
C. S. Koch, president, Fort Pitt Steel Casting Co.
John M. Olmsted, vice president and general manager, Electric Steel Co.
T. S. Quinn, treasurer, Lebanon Steel Foundry.

TECHNICAL COMMITTEE

Chairman, William J. Nugent, vice president and works manager, Electric Steel Co.
R. J. Doty, vice president and works manager, Sivyer Steel Casting Co.
C. S. Koch, president, Fort Pitt Steel Casting Co.
T. S. Quinn, treasurer, Lebanon Steel Foundry.

The question of selling prices for castings was banned from the start. Costs were considered only as an abstract problem; but the scientific study of costs to bring about more economical manufacture while maintaining and, when possible, improving quality, has been one of the most beneficial results of the association.

The group's scheme of operation may be briefly indicated under five main heads. Broadly speaking, the results are obtained through the following means: Frequent meetings of group representatives; investigations authorized at these conferences and conducted at suitable plants; general inspections of each plant by the research director; transmission regularly of reports to and from the director; and the use of the director's office as a clearing house and distributing center for all technical information of value to the members.

The meetings are held frequently and usually last for three days. In most cases they are held where one of the member plants is located and each such plant is visited at a time when the greatest benefit may result from critical and thorough examination by all representatives of the accomplishments of the investigation at that time justifying joint consideration on the ground. These meetings are attended by the principal operating executives themselves and, as occasion may warrant, by some of their chief subordinates in close touch with the problems under consideration. Consequently, questions of operating expediency can be decided immediately through the authority vested by each company in its delegated representatives. The great advantage of this will be obvious.

A typical meeting is a scientific convention in miniature. The members to whom the group has delegated specific researches are required to present detailed written reports of these investigations showing the progress to date. These reports are mailed by the authors to each of the plants and to the director sufficiently in advance of each meeting to permit prior study by all conferees. The critical consideration given these progress reports is exhaustive, and leads to agreement as to the further steps for each investigation. These occasionally require the participation of more than one plant in one research to test the application of a theory under different local conditions. Supplementing the reports by the members, the research director analyzes the status of the

work and presents for consideration such additional problems for investigation as he feels profitably may be attacked next. Before adjournment, definite decision is reached on all matters the solution of which is possible, thus permitting the group to function with the utmost dispatch.

Research in each case is assigned to the plant believed to have the most suitable personnel and equipment for the purpose after recommendation along these lines by the director. Such an investigation is conducted at joint expense. It requires the immediate supervision of a properly qualified man who in many cases for a time may be the operating head of the member plant. In every instance this individual is held responsible. The serious manner in which the work is carried on will be apparent from this. The man on the ground making an investigation is given all possible assistance by the director who periodically visits the plant for personal participation in the researches under way. An exhaustive record is kept of every detail of each research. Therefore, the complete series of progress reports on any investigation is convincing.

FEDERAL SPECIFICATIONS BOARD

U. S. Bureau of Standards

When General Dawes started to put the budget system in operation in the various Departments of the Federal Government, it soon became apparent that it would be necessary, in order to inaugurate an effective purchasing system, to first provide specifications for a vast number of articles. Considering the fact that Government specifications have long been a bugbear to those who have had experience with Government Departments as customers, it might seem that there were too many Government specifications already. Since in many instances, different Departments had different specifications for the same thing, this may have been the case; the need was not for more specifications but for *one* adequate specification for each product or material. Standards of quality had to be established and uniform specifications prepared.

In order that this stupendous undertaking should be carried out systematically, a new agency, to be known as the Federal Specifications Board, was created by executive order. It was entirely logical that Dr. Stratton, Director, since its founding twenty-one years ago, of the Bureau of Standards, should be made chairman of this new board which has to pass on all specifications prepared for the use of the Government Departments. It is a matter for mutual congratulation, considering the standardization work that is being undertaken by the AMERICAN CERAMIC SOCIETY, that the Director of an institution which is already working in close coöperation with the Society should be at the head of the organization which is to unify the government standards.

Germany Tending to Impress its Industrial Standards on All Import Countries

American Engineer, Back from Germany, Reports Industries There Gaining Big Advantages through Standardization

"The day may not be far distant when American manufacturers will receive inquiries from oversea countries to furnish goods according to the German national standards, and it behooves us to plan in time to meet such conditions."

This statement is contained in a communication to the American Engineering Standards Committee from Oscar R. Wikander, an American engineer, who has just returned from Germany, where he represented the A. E. S. C. in conferences concerning the international standardization of ball bearings.

Describing the great strides in standardization that have been made by German industries during the last few years and the important foreign trade advantages accruing to German industries because of their intense standardization activities, Mr. Wikander said:

"There is no doubt in my mind that one of the main reasons why forward-looking Germans force their standardization work is because they want to introduce German standards in the great importing countries, and possibly in the whole world. Holland, Switzerland, Austria, Sweden, and many other European countries follow the German lead very closely. The great German deliveries in kind to France will no doubt be made as far as feasible according to German standards, thereby introducing them in that country.

"It was only a few years ago that the 'Normenausschuss der Deutschen Industrie,' an organization corresponding to our American Engineering Standards Committee, was formed but the amount of work which it has already accomplished is stupendous. The 'Normenausschuss' has already issued several hundred sheets of approved standards, and about twice as many are already published as proposed standards. This enormous output of the German organization has led many to believe that it was merely a factory, producing 'paper standards,' and that its work was not to be taken very seriously. A personal investigation convinced me that this is not the case, and I found that the great output of standards was merely due to the enormous efforts put forth and to the enthusiasm of the great majority of the interested parties.

"This enthusiasm is due to a more or less general recognition, created under the pressure of war conditions, of the great economic value of standardization, and to the very generally accepted opinion that a standardized industry would be one of the strongest weapons in Germany's struggle for economic rehabilitation and financial reconstruction.

"To give a concrete illustration of this point, I may mention that at the time of my visit, a syndicate of nineteen German manufacturers and one Swedish manufacturer were executing an order for seven hundred locomotives for Russia, all of the same design, and every part in every one of them was being made interchangeable with the corresponding part in all the others, all parts having been manufactured to the same fits and tolerances. This feature will have the great advantage of permitting the Russian railroads to use any disabled locomotive as a store of spare parts for all the others. In one case a locomotive was assembled from parts machined in twenty different shops, with no more difficulty than a locomotive which was built complete in one shop. In case of future orders, the Russians will no doubt specify that all new locomotives of this class be built not only of the same design as above, but so that every part is interchangeable with the above.

"It is easy to realize what great advantages German manufacturers of locomotives will have over those of other nations when competing on the basis of such specifications, and this example illustrates the economic advantage which can be gained by German industry in introducing its standards in all countries importing mechanical equipment.

"Another error in our conception of German standardization is the belief that the 'Normenausschuss' is autocratic in its methods and is not in as close contact with the industries as our own standardizing bodies. I found, on the contrary, that absolutely the same methods are used there as here to arrive at national standards. The staff of the 'Normenausschuss' is merely coördinating and directing the work of the various committees, and the actual work in establishing standards is left to such experts as are recognized leaders in the various industries.

"The 'Normenausschuss' is a big organization built up along the same lines as the American Engineering Standards Committee. Its personnel consists of the same high

grade type of men as selected in this country for that kind of work,—only there are more of them and their work is greatly facilitated on account of the eager response from the German industry, whose leaders look to standardization as one of their greatest hopes for salvation.

"Many of the big German manufacturers have standards departments of their own, with a number of engineers and draftsmen working permanently on national standards. I found the staff of the 'Normenausschuss' greatly interested in American standardization and very anxious to collaborate with us in establishing international standards.

"It was proposed that they should send the American Engineering Standards Committee all the drafts of any importance submitted to their own committees for consideration, so as to make it possible for them to obtain American comments on important propositions, which might be of value in making final decisions. It was also suggested that the American Engineering Standards Committee keep the 'Normenausschuss' posted on its more important work. It would, of course, be highly desirable to establish international standards and great efforts are being made to obtain them in certain lines, such as ball bearings.

"The days may not be far distant when our manufacturers will receive inquiries from oversea countries to furnish goods according to the German national standards or specifications, as referred to above in connection with the Russian locomotives, and it behooves us to plan in time to meet such conditions, England seems to have realized fully the importance of recognition of her standards, and is trying to force the adoption of them in her colonies and dominions.

"On account of its very efficient organizations, the German Standards Committee has come to play a more important rôle in the industrial life of the nation than originally expected and manufacturers write to the 'Normanausschuss' for advice on questions of the most intricate nature.

"In conclusion I wish to express the hope that the example of the German engineers and manufacturers may spur us to make equally large contributions in work and money to the cause of standardization, and that our leading engineers may try to realize the enormous economic importance of both national and international standards."

Storage and Transportation of Portland Cement

(With a Bibliography)

By W. M. Myers. (Assistant mineral technologist, U. S. Bureau of Mines).

The U. S. Bureau of Mines conducted an investigation to determine the cause of the deterioration of Portland cement during storage and transportation, and to discover a means of preventing it. All available printed sources of information on this subject have been examined and a bibliography has been compiled. The subject has also been discussed with the leaders in the cement industry; the present report is the result of their coöperation, and is based principally on information thus obtained.

Deterioration of Portland cement during storage over any considerable period of time has long been noted; closely related to it is deterioration of cement during transportation, which involves not only the time factor of storage but also exposure to varied climatic conditions. Deterioration in both cases is due to hydration of the cement by absorption of moisture from a humid atmosphere, or by exposure to actual rain-fall. After hydration cement possesses no cohesive power; the degree of deterioration is directly proportional to the degree of hydration.

The amount of deterioration of Portland cement during storage has been accurately determined in an investigation by the Structural Materials Research Laboratory, in

coöperation with the Portland Cement Association. Cement stored in a shed in cloth sacks retained 80 per cent of its original strength after three months' storage; 71 per cent after six months; 61 per cent after one year; and 40 per cent after two years.

Storage and Transportation of Portland Cement in Bulk.—Deterioration of cement stored in bulk is less than in bags, owing to the smaller area exposed. Hydration takes place only at the exposed surface, and the bulk of the cement is unaffected. Cement transported in bulk must be shipped in a tight, closed car, and must be protected from moisture during loading, shipping, and unloading, preferably it should be used immediately after unloading at the point of destination. This practice is now followed by several manufacturers and where conditions are suitable it is becoming more common as its advantages are seen. Shipping in bulk effects a saving by eliminating the use of bags—which is an important item in the cost of cement and it should also permit a saving in freight rates.

Storage and Transportation as Unground Clinker.—Clinker, the fused product of the cement kiln before it is ground to form the finished Portland cement, is exceptionally well adapted for transportation or storage over long periods of time under adverse conditions. It is extremely inert and has no tendency to absorb moisture. Experiments show that clinker may be stored under water, or subjected to alternate dry and wet storage, without lowering the quality of the finished cement.

This cement has two distinct advantages: The quality of the cement produced from stored clinker is higher, and the grinding cost of the clinker is decreased because of mechanical disintegration.

The improvement in the quality of cement made from stored clinker is due to the hydration of any free lime (CaO) that may be present. Free lime is injurious to the finished cement, as it produces unsoundness. It is not present in a perfectly burned clinker, but it is present occasionally as a result of imperfect mixing of raw materials and of careless manipulation. Cement manufacturers, therefore, generally store clinker for several weeks or months before grinding. Clinker that produced unsound cement in one instance was found to yield a satisfactory product after being treated with steam to hydrate the free lime.

Though Portland cement in the form of clinker is most carelessly handled and stored without regard to humidity or climatic conditions, yet improvement rather than deterioration of quality is manifest in the ground product.

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1921. November p. 71–74
1921. December p. 95–99
1922. January p. 11–14
1922. February p. 30–34

Management Week

The American Society of Mechanical Engineers has designated the period from October 16 to 21 as "Management Week" in order to stimulate interest in the solution of problems of management in industry. During this time meetings will be held by the Local Sections in coöperation with other engineering societies, including the Taylor Society and the Society of Industrial Engineers.

BULLETIN

of the

American Ceramic Society

A Monthly Publication Devoted to Proceedings
of the Society, Discussions of Plant Problems, Discussions
of Technical and Scientific Questions and
Promotion of Coöperative Research

Edited by the Secretary of the Society Assisted by Officers of the Industrial Divisions

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EDITORIAL

THE VALUE OF DISCUSSIONS

Ability to reason distinguishes man from other animals, and men are distinguished from one another by difference in ability to reason logically, the successful men being those who are most logical. Ability to reason logically is one of the gifts not possessed equally by all men, nor can it be acquired by all to the same degree. Furthermore, no man is equally logical in all lines of thought. Most successful bankers would be less successful lawyers, and most successful works managers would be less successful accountants. Each man has his own calling, but in whatever line a man may be engaged his success will be in proportion to his ability to reason.

Experience has shown that the musician, the poet, the lawyer, the merchant, the works manager, the sales manager and the man in any of the other vocations will attain his greatest ability to reason only by continued orderly practice. Ability to reason in mathematics is acquired only by solving problems; in law by practicing law. Studying and thinking are requisites but reasoning power will be developed only when the things studied and the thoughts evolved are marshalled in an orderly fashion to some definite purpose, as one does when speaking or writing to convince or to make plain to another person. Just as surely as the weak points in design are discovered only in the detailing on the drafting board, so the defects in reasoning are brought out in written and oral discussions.

Unless man reasons through to a demonstrated fact he has not acquired knowledge or ability, in fact he will have nothing more than a jumble of experiences. Herein lies the benefit of participating in discussions and in the writing of papers.

Information will be acquired by those who hear or read the discussions and papers but by far the largest amount of definitely acquired knowledge and increased ability will accrue to him who does the telling, especially in debate for in discussion one must focus his experiences and observations in orderly reasoning to a definite conclusion. The reader will have the results but he who has marshalled his experiences, fitting them together to form a conclusion will have derived the greater benefit. It is he who has done the orderly reasoning from premises experienced, rather than he who merely reads or hears, who profits most in increased ability to reason, and it is he who has acquired the greater ability to reason logically who will best succeed in his chosen vocation.

The Silver Jubilee Convention to be held by this Society in Pittsburgh, February 12–16, 1923, and the Bulletin section of this *Journal* offer opportunities for the ceramist who wishes to develop reasoning ability to the maximum of his possibilities. These opportunities are taken by the most successful ceramists. These opportunities are for all who will use them and one so doing can count on the balance in benefits derived being in favor of those who take part in the discussions and of those who write up their experiences and observations.

COLLOQUIUM ON FELDSPAR

Correction

By V. A. Stout:[1]—On Page 139 in your August issue, *Bulletin* section, in the Colloquium of Feldspar and Feldspar Grinding, I note that I have made a very serious error in the calculation of the cost of power for grinding in the Hardinge Mill continuous system, as well as in the old system of chaser and batch mills.

This error consists in a decimal point, changing the figures as follows:

193 H. P. hrs. at 1½c per H. P. hr. divided by 3 tons per hr. = 96.5c per ton.

This changes the cost of milling per ton of ground spar for the Hardinge Mill continuous to $2.40 per ton.

By a very peculiar twist, the same error was made on the tabulation of costs per ton of ground spar by the old system and the first item should read:

Power at 1½c per H. P. hr. = $2.00

making these costs $4.90.

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The Editor has had conference with a few feldspar millers and users with whom he has met incidentally here and there with the net impression left that the most essential thing is a survey of the user's requirements, the permissible variation in composition, fineness and freedom from coloring and specking material.

The closed circuit continuous grinding provides for splitting the material from the mill according to size of grain, the coarse material being returned for further grinding. This is done for two reasons: (1) to insure that the entire product is ground to the minimum fineness and (2) to lessen the cost of grinding. With batch mills the product is ground under the given conditions of quantity charge and speed of mill until a wet screen test shows a given allowable residue on a 160-mesh screen, no separation of the sufficiently fine from that which is too coarse being attempted.

Practically all of the larger feldspar millers are credited with making a careful selection of the rock feldspar to insure uniformity of product and practical freedom from impurities. Each of them have established the confidence of the large users on the basis of this uniformity. Judging from the tons of discarded feldspar rock at one of the mills which, from casual inspection, appeared to be clean orthoclase, it seems true that the customers' requirements are the criteria of the character of the product which that mill will produce. This discarded feldspar, I am told, is giving satisfaction elsewhere. Hence, I assume that it was discarded at this mill because the product from it varied too much from that to which its customers were familiar.

One user requires two radically different feldspars, (1) easily fusible soda, and (2) refractory potash feldspar. The mixture in which the former is

[1] Received August 9, 1922.

used is not ground to pass a 40-mesh whereas the mixture containing the potash is finely ground. This user, therefore, has two widely varying specifications as to composition and fineness of grind. The soda feldspar used in the 40-mesh batch must be wholly 160 and finer, whereas the "run of mill" of the potash feldspar will satisfy the requirements of the finely ground mix.

One large user has just recently reported relative to tests of feldspar that they have been using Canadian feldspar for some time and that the principal objection has been that they were not ground uniformly although the manufacturers claim to grind to 140-mesh. "In the grinding of our ground coat enamels we grind it rather coarse as we find that we can manipulate the ground enamels best when they are not too finely ground. We usually grind our ground coat enamels to about 40-mesh and we have been troubled with small particles of substance that will not fire down in our muffles, protruding through the surface of the ground coat. Those small particles either make small defects in the finished ware or fall out in the finishing process and sometimes leave a small spot of exposed steel or a small bubble where the white enamels come in contact with the steel."

"After investigation we traced this down to the fact that there were unground pieces of feldspar in the material we have been using. These pieces in some instances are almost as large as small marbles and we find that they do not smelt in the smelting operation. We also find that they are only reduced in our grinding mills and many of these pass through the 40-mesh sieve, and since our ground coat, when it is fired, is not as thick as these unground pieces of feldspar, they protrude through the ground coat and cause the above explained trouble."

"We have purchased small lots of feldspar from several sources and on sieving it we find these unground pieces exist in every lot of feldspar we have purchased from the several well-known sources."

"When the enamels are not finely ground and the coats put on very thin, we find these unground particles are very objectionable."

A manufacturer of vitrified china has made the statement that no sample of feldspar submitted to him recently has been free from dark specks. The specks are not visible to the naked eye in the fused feldspar but are easily seen through a hand magnifying glass.

Another potter has said that he purchases feldspar on price basis from millers who have the capacity and intelligence to produce material that will be uniform from shipment to shipment, because all of them contain coarse material and none are free from black specking material.

Users of feldspar ground in batch, tube, and conical mills have like statements to make regarding the product. So far as is now known, the product has not been sufficiently improved to warrant the expense of air or screen separation of fine from the coarse, nor to attempt to free the

product from the iron impurities. This does not seem logical and it is not logical; there must be misdirected effort prevailing for it surely is true that the millers are now striving to produce quality feldspar.

If samples could be collected from the several producers, examined by petrographers and chemists, and tested thoroughly without prejudice, the ceramic trade could possibly work out practical specifications. With this, however, must be a survey of the quality requirements of the users. Will the feldspar producers and users unite in support of such an investigation?

Standard Specifications for Feldspar

By. W. H. Landers:[1]—It would seem that the discussion on feldspar has reached a point where little further progress can be expected until Standard Specifications are agreed upon. Of course such Standard Specifications will have to be within reasonable limits of the supply of raw material available and the ability of the millers to convert this raw material to these specifications.

Taking the first question, it will be recognized that regardless of whether the feldspar be soda, potash, or soda-lime-potash, the nature of its occurrence is such that the associated minerals, quartz, hornblende, tourmaline, magnetite, ilmenite, garnets and both the micas, will always be present to a certain degree. In many feldspars, graphite, manganese minerals, and sometimes chromite appear. Some unaltered pyrite is also found, although of rare occurrence.

With the long string of the above objectionable minerals, we have, according to whether the feldspar is mined from the surface or deeper deposits, some of the above in various degrees of alteration.

It is recognized that while all of these minerals do not occur at the same time in feldspar of each district, each one of them is supposed to constitute an impurity from the user's standpoint.

In considering Standard Specifications it would be well for the users in each industry to make known as soon as possible just what effect each one of these minerals exerts on their products. There is small likelihood that he is so familiar with this phase that he can at the present time answer this question.

It is also known that the amount of impurities present is the vital factor and that there is available at the present time no quick and accurate method of determining this percentage. This is particularly true of the R minerals of which garnet is the principal offender. What constitutes impurities to one branch of the trade is not necessarily an objection to another branch. For instance, in the glass trade, mica, some garnets and other minerals are not recognized as objectionable so long as the total

[1] Received August 9, 1922.

iron content is kept down to a very low limit. Silica cannot, within reasonable limits, have an adverse effect on the quality of the ware turned out, but enters into the question largely from a price standpoint. Free silica is difficult to determine in the laboratory, but total silica in the feldspar can be satisfactorily limited and this will automatically take care of the free silica question.

It is suggested that the user be liberal in this regard, and that specifications be adopted making more important the question of combined alkali, and limiting the amounts of other impurities.

The original condition of some impurities exerts a great influence on the appearance of the finished product, and the chemical analysis cannot be taken as the whole story. It has been found from experience that certain lots of feldspar from one district, while almost identical in analysis to other feldspars of the same district will fuse white in a biscuit kiln, while the other samples will have a slight brownish tint, both samples having previously given perfectly white buttons, free from visible spots, when fused in a gasoline or gas-fired muffle. These results were the same whether the feldspar had been ground wet or dry, and whether the ground feldspar had been "purified" after having been ground either wet or dry.

Just why this occurs is a matter for further research, and is quoted as tending to show how feldspar taken from one deposit may be expected to vary without visible warning. It has been suggested that this phenomenon is caused by the different degrees of oxidation of the iron minerals, and that when mining is confined to zones where the iron and R minerals are either pretty well oxidized or where they are unaltered, the ground feldspar resulting will be uniformly of one or the other color, *i. e.*, white or slightly brownish.

As this difference may be serious to only a small part of the trade, it is hoped that each of the three great users, manufacturers of pottery and tile, enamel ware, and glass ware, will adopt entirely separate Standard Specifications and that the miller will not be required to guarantee ultimate results when manufacturing within these specifications.

Lime.—From time to time one hears that lime is a detriment to the potter and that both the enamel and glass ware people use lime in their mix. Lime cannot be much of a factor as it rarely shows as more than a trace in the ground or crude feldspar, and is far more likely to creep into the ware, from the use of plaster of Paris moulds. Magnesia is generally present to a greater degree and should be discussed separately from lime.

Potash and Soda.—The question of the predominance of potash over soda, or vice versa is one for the user to decide as the millers in most districts are unable to mine or secure crude feldspar that does not contain both soda and potash.

Alumina.—The value or the effect of alumina seems to be very loosely discussed or understood, and one often hears one user say that alumina reduces the fusing point, and another makes just the opposite statement. They cannot both be right and the discussion should shed some light on this subject. The removal of garnets and mica cannot be accomplished without affecting the alumina contents.

Iron.—Iron in this, as in most chemical products is the "great bugaboo;" no matter what happens, the trouble is blamed on iron. With the exception of the glass trade where the effects of iron are definitely known, it does not seem clear, outside of the question of causing black specks in the ware, just what results from the presence of iron and whether the same effects are secured from the various oxides of iron as are noticed from the occurrence of metallic particles only.

It seems to be definitely established, however, that next to the elimination of iron to start with, its bad effects are considerably minimized by extremely fine grinding.

So far, no one has been able to prevent dark specks completely in the fused samples when these are examined under a magnifying glass. There is no excuse, however, for these specks to be of such a size as to be plainly visible to the naked eye. It represents bad milling practice or the improper choice of crude material.

It is safe to say that while today most of the grinding mills are extremely careful in their choice of crude feldspar, too much is taken for granted in the subsequent treatment of this crude material, and that plain engineering by some one not *too* familiar with the feldspar industry would greatly improve the quality of the product they turn out, especially as regards these iron specks.

Iron gets into the feldspar from many sources outside of its natural occurrence. First, we have that picked up in the mining operations, from the breaking and handling of the material with iron and steel implements. If the wear on these tools is considered, it would calculate too small a quantity to cause concern, but who has ever conducted an operation without noticing the presence in the material of all kinds of tramp metal such as nails, drill points, tobacco cans, links of chain, spikes, hammer heads, rivets, etc.?

When it is remembered that it takes only one small speck of iron to spoil the appearance of an expensive piece of china or tile, it will be realized that this matter is hardly one of definite percentages.

Secondly, as we move the crude feldspar either in mine cars, wagons, or in railroad cars, it is further subjected to contamination, and finally when the crude material gets into the mill, it already contains some considerable tramp iron minerals in the feldspar itself. Cinders from locomotives and hoisting engines, and large pieces of iron rust from open-top

cars, are among the various articles picked out by powerful magnetic head-pulleys, when such a device is used just prior to the grinding of the ore.

To any one who has had experience in the use of magnetic separators of the low intensity type, of which a magnetic head-pulley is a good example, it is at once apparent that the material eliminated at this point represents only the larger and more highly magnetic pieces. From the very nature of the design of the magnet, it can be expected that every large piece of feldspar will be moved aside to allow the feebly magnetic particle under it to be attracted.

There seems to be only one way to handle this problem of iron, and that is to use ordinary, good care in the choice and preparation of the crude material for the mill, and then to use such devices or processes in the milling, as will eliminate such iron either magnetic or non-magnetic, as may be enough to cause visible specks in the fused ware, without the use of a magnifying glass.

Considerable discussion has already taken place on the respective merits of sledging, followed by chaser stones, as against breaking in rock crushers, followed by further reduction in conical or cylindrical mills. It is a very difficult matter to exactly determine just how much iron is added in either case; the principal trouble being to take accurate head samples before the crude is reduced to a comparatively finely ground state. Measurements have been taken with great care, and over long periods of time, of the wear of jaw crushers when operating on various harder and softer rocks than feldspar, and some figures are available, as to the weight of metal worn away per ton crushed in the feldspar industry. This is so ridiculously low that one is inclined to question whether there is not actually as much iron added to the feldspar by hand sledging, plus the occasional broken hammer, and by the gears of the chaser stones, as may come from the more economical, and in every way more desirable rock feldspar.

It would be interesting to get an analysis of some of the chaser stones now used.

Passing these preliminary stages of coarse crushing, it will be seen that intermediate grinders, such as conical or cylindrical mills, have very little chance of adding any iron when lined with silex: this same applies to tube mills, either continuous or batch, although any one who has taken the gratings off the dump holes of batch mills and thoroughly cleaned them out is frequently surprised at what is found inside, in the shape of nuts, bolts, etc., that seem to have no reason for being there after all the agonizing care that has been taken to keep the feldspar away from iron.

During the milling process, the most prolific source of iron is from the types of conveying machinery generally used. Again we have the apparent necessity for the careful engineering of these problems by some one who is

not willing to accept present practice solely on the theory "that most mills have always used such."

As it is not the object of this contribution to enter into the respective merits of the various types of machinery, wet or dry grinding, or other factors such as costs, entering into the preparation of feldspar to meet Standard Specifications, this seems a good point to turn to the next mineral found in feldspar.

Mica.—Mica as generally found in feldspar is of two kinds: the muscovite, which is chemically harmless, and the biotite, which may contain iron either chemically combined or as isolated pieces of oxide between its laminations. One or both of these micas is always present in feldspar, and it becomes a question as to how much, or rather, in what form, mica can be permitted in the finished product.

Some members of the glass trade have stated that the presence of mica, other than its influence on the iron content, is no detriment in any form, but as much of the mica is practically infusible under conditions met in the pottery and enamel traces this question is reduced to that of how coarse can mica be permitted in the specifications.

It is entirely practical to eliminate most of the mica at certain stages of process, while grinding wet, but no way has been found to get it out in the dry state. As most of the feldspar comes at present from dry grinding plants, they will be chiefly interested in the fineness permitted.

Garnets.—So many types of garnet occur in practically all feldspars, that this question becomes one of prime importance. Most garnets are more fusible than the feldspar itself and have the objectionable property of spreading through the semi-fused enamel or glaze, and while not causing clearly defined spots, like iron, do result in somewhat off-color ware.

This problem of garnets will be one of the hardest to settle in adopting specifications, as there is no way of determining the exact percentage of garnets present. All garnets are not even slightly magnetic, but as they readily concentrate in a vanning pan, some method of estimating their amount may be developed; this has been done with approximate results by the miner in free gold mines, to determine the amount of gold in the ore.

The amount present can be substantially reduced in either the wet or dry state, but never can be entirely eliminated. How fine the remaining garnets are, can have little bearing on account of the lower temperature at which they fuse.

Tourmaline and Hornblende.—These are both silicates of the R series and may or may not cause off-color ware. For this reason, they form two of the objectional impurities in certain districts. It is barely possible that the allowable amount of these can be controlled along somewhat similar lines to garnets. This has been done quite successfully in a laboratory

way, but there is no available knowledge of a successful effort being made to reduce or eliminate either of these on a tonnage basis in process.

Coal Dust and Cinders.—These, if low in iron, seem to have no bad effect, but it is not definitely known just what part native graphite may have in producing off-color fusions; this matter can easily be determined by simple research, and should the graphite be objectionable, its almost complete removal can readily be accomplished in process.

Moisture.—The foregoing discussion covers only the question of impurities that may be present in the crude ore or picked up in process. There has lately developed a question of moisture or dryness, with the attendant one of lumps on the ground product.

As these lumps are composed of most finely ground feldspar and are only loosely cemented together by the small amount of colloidal matter present, they present a problem only to some of the enamel ware people. The finer the product is ground, either wet or dry, the more lumps will appear in the finished material when received.

Lumps are not peculiar to wet-ground material, but as their size, if not disintegrated before shipment, is more apparent, there have been some complaints on this score.

Many tests on dry-ground feldspar have indicated, especially when very fine, that depending on the humidity, it can be expected to take up from $^1/_2$ to $1^1{}_2\%$ of moisture from the air, particularly when loaded warm.

Feldspar, when ground to pass 140-mesh, dusts very badly in handling but it contains less than 2% moisture, and this suggests that it might be much to the advantage of all concerned as tending to prevent losses and injury to the health of the workmen to allow, if not actually to require, from 2 to 3% moisture in the ground feldspar when received. Some states will undoubtedly legislate against *unnecessary* dust in this, as they have in other business.

The question of unground lumps will be discussed under the next topic, the all-important one of fineness.

Fineness.—Requirements as to fineness must be considered from the users' standpoint.

The *potter* can secure his feldspar ground from all of the present mills so that less than $^1/_2$ of 1% remains on 140-mesh Tyler standard screen. In some processes, what remains on 140 will be practically all mica which has previously gone through 100-mesh screen.

It is practically impossible where batch grinding is used, to guarantee the absence of large unground pieces, particularly bits of grinding pebbles, but in this case the balance of the feldspar will be much finer than 140-mesh, in order to average down the weight of these larger pieces.

There is no limit except that of time and cost, as to how fine feldspar can be ground, although it is a difficult matter to satisfactorily get a finer prod-

uct than that above, by the use of air separators operating in closed circuit, or by the use of screens which becomes impractical to the dry grinder, when he must use finer than 50-mesh cloth. These statements are not meant to imply that finer results cannot be attained when using air separators or screens, but that it would be impractical to do so with any hope of marketing ground feldspar at the present or a reasonably higher cost.

A very important specification would be a clean-cut adoption of some standard test screen, such as the Tyler Standard or a U. S. Standard; both cannot be used as there is quite a difference in the size of particle going through a given mesh in each.

Methods of grinding influence the range of sizes, but in general, if $^1/_2$ of 1% remains on 140, there will not be over 5% on 200. It would seem better to adopt as coarse a mesh as possible and reduce the amount allowed to remain on this in order to facilitate the making of screen tests, both at the mill and at the plant of the consumer; very fine mesh test screens are costly to buy, do not last long before becoming inaccurate, and consume too much time in their use.

Some potters propose to use a rising current of water of definite velocity as means of determining fineness. This will not do at all as a standard, for the reason that different feldspars settle at vastly different rates, according to the shape of each particle, which shape is somewhat influenced by the grinding method used and the amount of impurities present. A wet-ground feldspar may settle as fast as five times the rate of a dry-ground feldspar and yet both will give identical results on a complete screen analysis. A few degrees of temperature may greatly change results as may the presence in the water of various mineral salts or organic matter.

Test screens with a definite opening will give the only positive results, unless the potters demand feldspar ground finer than 200-mesh; this fineness can be practically attained only by grinding in water.

It is recognized that some potters may demand a different fineness for use in the body to that necessary for use in the glaze, but it would seem far more satisfactory for each user to put in his own equipment to take out some of the very fine feldspar for the glaze from his standard feldspar, leaving a residue free from colloidal matter and most likely in a better state for working up in his clays and other materials that enter into the body.

The *enamel* trade, from what little can be gathered (mostly from their complaints), would like to get a feldspar free from lumps, which would leave no residue on an 80-mesh screen, and contain no material finer than 250-mesh. Such a feldspar would be in the nature of an extremely fine sand, would contain no lumps of any description and would fuse far more easily than feldspar containing finer material which would tend to form lumps during their process. This feldspar would be an intermediate size

but might be difficult to produce at some of the present mills. It is worthy of discussion, however, as it is possible to produce such a feldspar at a reasonable cost.

An intermediate size such as this would contain fewer impurities than either the coarser or finer products.

This same trade at present is generally supplied with feldspar ground to pass a 40- or 50-mesh vibrating screen set on a steep angle, which gives a fineness of approximately 90- to 100-mesh, but it does not guarantee that it will not contain quite a few pieces of 40- or 50-mesh material. The air separators on this product give about the same result.

The *glass* manufacturer uses comparatively coarse glass sand, some as coarse as 30-mesh, and it would seem that there would be no objection to their using feldspar of approximately the same fineness.

They could quite profitably use feldspar which had passed through 40-mesh but remained on 100, and contained not over 10% finer than 100. Such a feldspar sand can be very cheaply produced on a tonnage basis, will give very little dust in handling, and will be naturally of low moisture content.

It can be brought down to a very low iron content, and although it might contain considerable mica, 30-mesh and finer should be satisfactory for their use especially where price and tonnage play such an important part.

There is an almost unlimited quantity of crude feldspar available that can be milled to meet any reasonable specification, where white opaque fusion is not required, and the allowable silica and iron content be over 70% and 1%, respectively.

As stated at the beginning of this contribution, its object is to further the adoption of Standard Specifications or at least to promote helpful discussions of this subject.

The user can be concerned only in securing a suitable feldspar at a reasonable cost and should try to get adopted for his branch of the trade, a set of specifications under which it is practical to produce ground feldspar from the sources available, and by milling methods which are considered practical in a modern way.

Just so long as no Standard Specifications exist, there will be unsatisfactory and un-uniform feldspar produced with a steadily mounting cost to the consumer and possible bankruptcy to the miller.

Adjusting differences between the miller and user is one of the largest items entering into the present cost of producing ground feldspar. Too often does it occur that shipments are refused for no other reason than the shop superintendent's prejudice against the appearance of the raw feldspar. A few simple laboratory tests would indicate that this feldspar was as good as any previously used. Few millers have to date produced feldspar that is always of the same color, fineness, or moisture content.

When feldspar is ground to a definite specification, the manufacturer receiving this feldspar should be obliged to accept at least that shipment without further expense to the producer.

It will be time enough when standards are adopted to improve present milling practice or develop new processes.

By Raymond B. Ladoo:—This paper by Mr. Landers is very timely as it goes to the root of much of the trouble which has been found with commercial feldspar. It is very necessary that both the feldspar producer and the consumer agree upon standards of feldspar for various uses, not only upon grades but upon types of feldspar and fineness of grinding. This subject must be approached, however, with great care for opinions as the needs of individual consumers differ widely. There are also considerable differences in feldspar deposits.

Specifications to be workable and satisfactory to both producers and consumers, must be formed by the joint action of men of wide experience, representing both producers and consumers. Standards set up by only one side or one phase of the industry have often been found unworkable and a source of trouble rather than a help. Wide experience is needed for conditions of production and consumption differ so greatly in different districts that generalizations based on experience in one field only are often dangerous and misleading.

The terms "standards" and "specifications" have been used rather loosely at times with the result that at present they do not always convey the same meaning to different people. Of course absolute standardization of feldspar in the sense that is implied in the standardization of screw threads, of rail sizes and weights, etc., is impossible. Instead an attempt should be made at first to draw up specifications for different uses giving rather wide tolerances. Such specifications might mention the most acceptable fineness of grinding, the total alkali content, the maximum allowable iron content, or whether or not impurities such as tourmaline, hornblende, garnet, pyrite, biotite, etc., shall be tolerated. It would be expected that these specifications would be revised at stated periods improving them and making them more specific as knowledge of production and utilization increases.

The following comments are based on Mr. Landers' paper:

On page 271 it is stated that the common minerals associated with feldspar, for example, quartz, hornblende, tourmaline, etc., "will always be present to a certain degree." While it is true that most pegmatite deposits contain some or even all of the minerals noted it is often the case that these minerals are segregated along the walls or in other portions of a deposit and are not mixed with the massive feldspar. Thus it is sometimes possible to mine feldspar almost entirely free from any visible impurities.

In other cases it is possible to mine large bodies of feldspar which contain only quartz as a visible impurity. Portions of the dike carrying other impurities in such cases are left standing in the mine. Very large quantities of crude commercial feldspar are obtained which are practically free from the objectionable impurities noted.

On page 271, Mr. Landers mentioned "the R minerals, of which garnet is the principal offender." It is not quite clear what is meant by the "R minerals," but I assume reference is made to the complex silicate minerals which contain iron, manganese, and magnesium in varying proportions. While it is true that in some instances garnet is the principal impurity of this type, in other deposits garnet is subordinate or absent and tourmaline is the chief offender. In other cases hornblende or biotite or beryl occur in abundance and render feldspar worthless under present conditions. This is an important point because garnet, on account of its high specific gravity, may perhaps be eliminated by some system of mechanical concentration. Hornblende, tourmaline, beryl and biotite are too close to feldspar in specific gravity to make possible successful gravity concentration.

The problem of determination of free silica is difficult but it cannot be solved by merely determining total silica. The somewhat common practice of using total silica content as an index of the free silica content is incorrect and misleading for the reason that the different feldspars have different alkali-alumina-silica ratios. Pure potash feldspar (microcline and orthoclase) contains theoretically 64.75% SiO_2; pure soda feldspar (albite) 68.8% SiO_2; and pure lime feldspar (anorthite) 43.2% SiO_2. Thus it is possible to have a high total silica content with a low free silica content and it is also possible to have a low total silica content with a fairly high free silica content. Various types of pure feldspar, therefore, may vary in total silica content all the way from less than 50 per cent to about 69 per cent without containing any free quartz. In actual practice the only method of determining free silica (and this is only approximate) is first to make a complete analysis, and second to calculate from this analysis the mineralogical composition based on the amounts of alkalies and alumina present. The total silica required by each of the feldspars and by kaolin, if present, should be added together and this sum deducted from the total silica as given in the complete analysis. An actual calculation based on this method showed that in two analyses of the same feldspar the difference in total silica was only about 3% whereas by calculation the difference in free silica was about 12 per cent.

In the discussion of the effect of alumina, free alumina must be meant as the alumina in feldspar is a component part of the mineral and in quantity it bears a definite and unchanging ratio to the alkali of the feldspar. Any excess of alumina not required by the alkali present is usually considered

as kaolin (in a feldspar free from mica, garnet, etc.) due to greater or less alteration of feldspar. Sometimes this alteration is not visible to the unaided eye but is plainly visible under a microscope. Thus free alumina is rarely, if ever, present in feldspar. In pure feldspar any variations in the alumina content must mean a proportionate variation in the alkali content.

On page 273, it is stated that it has been impossible to eliminate completely dark specks in fused samples of feldspar when these are examined under a microscope. This is probably true of feldspar which originally contained impurities, but when a pure feldspar is fused black specks can be introduced only by careless handling either in preparing the material or in firing it.

I agree entirely with Mr. Landers' conclusions that iron may get into the feldspar from many sources so that feldspar which is iron free in the quarry may contain considerable iron before it reaches the potter. Precautions must be taken in mining, transporting and milling feldspar in order that iron may not be introduced, and if introduced may be removed during the milling process. However, as noted by Mr. Spurrier in a previous discussion, feldspar which is delivered to the potter in a practically iron free condition may pick up considerable quantities of iron in the pottery. The question of iron, therefore, is one which cannot be settled alone by the feldspar producer but part of the burden must rest on the consumer.

It is stated that mica, either muscovite or biotite, is always present in feldspar. In some districts this is true, but in some deposits in other districts feldspar practically free from mica can be obtained in quantity, in some cases easily and in some cases only by careful mining and sorting. Therefore, mica is not to be considered always as a necessary impurity. It has been commonly assumed that muscovite mica is chemically harmless but this is not always true. Muscovite is a mineral of variable composition; sometimes it may be iron free but in other cases pure muscovite may contain a considerable quantity of iron. Thus one analysis of a typical North Carolina muscovite mica shows about $2^1/_2$ per cent Fe_2O_3. This may be a source of iron which is sometimes unexpectedly found in feldspar. It is stated that mica is practically infusible under conditions met with in the pottery and enamel trades; but Watts[1] states that while muscovite alone fuses at cone 13, fine ground muscovite in potash feldspar lowers the deformation temperature and that the rate of deformation increases with increased proportion of muscovite.

Garnet, as noted previously is not found, at least in large quantities, in all feldspar deposits. Therefore, the problem of elimination of garnet is not common to all feldspar producers. It does not seem necessary to at-

[1] Watts, A. S., "Mining and Treatment of Feldspar and Kaolin," *Bureau of Mines Bulletin*, **53**, page 29.

tempt to define the permissible amount of garnet in feldspar for the color and appearance of fusion test pieces should govern in pottery feldspar, and the total iron content, as shown by analysis, in a feldspar for the glass and enamel trade. It should be possible to set up standards of color for fusion test pieces just as it has been possible to standardize color in white pigments and other materials where a pure white color is essential.

The problem of the separation of tourmaline and hornblende is a serious one and one which has not been solved. The specific gravity of tourmaline varies from 2.98 to 3.20; hornblende 2.9 to 3.4; feldspar 2.44 to 2.8 and garnet 3.15 to 4.38. It is evident that while the differences in specific gravity between feldspar and garnet are sufficient to allow a fairly complete separation by gravity methods the differences in specific gravity between hornblende, tourmaline and feldspar are small and are not sufficient to permit a successful mechanical concentration. The elimination of tourmaline and hornblende must, therefore, await the development of new and better methods of concentration.

On page 276, reference is made to the fine grinding of feldspar and it is stated that it is impossible to produce very fine ground feldspar commercially by the use of screens or air separators "at the present or a reasonably higher cost." While the economical use of screens for this purpose has not yet been definitely proved I think it has been definitely proved in a great many cases that very finely ground materials, not only feldspar but many other materials, can be separated successfully by the various systems of air separation now in use. The use of air separators for the classification of extremely fine ground materials has grown very rapidly within the past few years and the success of such methods cannot be questioned.

The present methods of determining the fineness of feldspar are somewhat unsatisfactory in that a determination of fineness is usually made on but one screen, the 140- or the 150-mesh. Grinding tests on many different types of material including feldspar have shown that two materials may show almost identical results on one screen but still contain very different proportions of extremely fine material. Thus, for example, two materials might show both a residue of only one-half of one per cent on a 140-screen, but one of these might show 50% on a 250-mesh screen while the other might show only 1% on a 250-mesh screen. Therefore, in order to obtain an accurate estimate of the fineness it is necessary to use not only a limiting screen but one or more screens which are much finer, or it is necessary to use some method of elutriation which will determine the relative amounts of grains of the different sizes. This method of determination of size by elutriation is slow and is often not necessary, but it usually gives accurate results on a material like feldspar. Feldspar ordinarily possesses a good cleavage and the shape of grain in fine grinding depends more upon this cleavage than upon the method of grinding. In the case of materials which

do not have a good cleavage the shape of grains is often influenced greatly by the method of grinding. While most present specifications for feldspar are based on a fineness of 99½% through a 140-mesh screen it is evident that most potters desire a large percentage of very fine material. It is suggested, therefore, that not only the 140-mesh screen be used but in addition the retention on a 300-mesh screen be specified.

It is stated that "a wet-ground feldspar may settle as fast as five times the rate of a dry-ground feldspar and yet both will give identical results on a complete screen analysis." It is important to know in this connection what was the finest screen used in this complete screen analysis and what were the relative amounts which were retained on and which passed through this finest screen. In these tests it is probable that some of the material was in a colloidal state and that the presence or absence of coagulating or settling reagents had more effect on the rate of settling than the absolute fineness. This matter should be investigated further and, if it is found that colloids have an appreciable effect on the rate of settling in feldspar elutriation tests, then any standards based on this method of testing should provide for the reduction of all samples to the same colloidal condition, that is, all samples should be treated either entirely free from settling reagents or should have definite amounts and the same amounts of such reagent present.

It seems probable that for most purposes the determination of fineness can be made best by the use of several screens of which the finest should be 300-mesh (or finer if obtainable).

While it has been demonstrated that very finely ground feldspar can be made commercially by dry grinding and air separation as well as by wet grinding, the relative costs and the relative merits of the two systems have not yet been established. It is conceivable that it will be found in some instances that dry grinding methods will be preferable and cheaper and in other instances wet grinding methods will be more suitable.

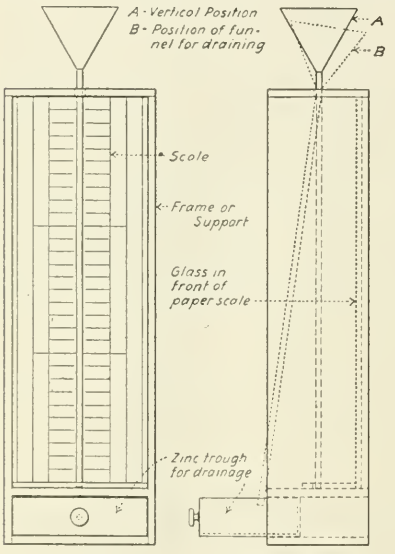
The whole subject of feldspar specifications for various uses should be gone into very carefully by a committee composed of both producers and consumers of feldspar. Mr. Landers' paper has pointed out the need for such work and I am heartily in accord not only with his efforts, but with his major conclusions. It is to be hoped that definite action may be taken on this subject soon.

Method and Apparatus for Quickly Determining Fineness of Grind

By Eric W. Turner:—When such materials as feldspar and flint are ground in the intermittent type of pebble mill, the determination of the finishing point has always contained the element of chance to an appreciable degree.

A mill of a certain length and diameter, revolving at a given speed and containing a certain weight of pebbles, will grind a standard charge of crude material to the required degree of fineness in a certain number of hours.

So long as the physical characteristics of the crude material remain uniform the period of grinding will remain approximately constant. However, should these characteristics fluctuate the period of grinding will vary accordingly. This factor has always been controlled by the man in charge of the operation. For instance, if the crude material is damper than usual he would cause the grinding period to be lengthened out. On the other hand, if the material was dryer than usual the grinding period would be shortened.



Apparatus for Determining Fineness of Grind

FIG. 1.

While the material has been ground supposedly to specification there has been no method for rapidly proving with practical accuracy that such is the case. The method of rubbing between the fingers or of biting it between the teeth is unreliable while the standard screen test is not applicable owing to the length of time each mill would be held up while the test was being made.

A shop test to be practical must be simple, rapid and economical so that it can be performed by the mill foreman without hampering production. In order to fill the want of such a test the following method and apparatus have been devised.

It is assumed in this description that the required degree of fineness is not less than 99% passing through a 160 brass screen of the Tyler testing type.

The cap is first removed from the mill and a suitable quantity of ground material extracted by means of a long handled dipper. From this sample 300 grams are weighed out on a rough pair of gram scales. A set of ordinary spring scales of the household variety is satisfactory. The sample is then transferred in the dry state to the test screen and the fines washed through with a stream of running water. The residue is rubbed with a camel's hair brush to make sure that no fines remain on the screen. The fines are allowed to run away as it is only necessary to determine the per cent of coarse residue. This is determined directly in the simple volumeter which is illustrated (Fig. 1).

This consists of a glass funnel with a long stem, a suitable support and a vertical scale graduated in tenths of a per cent. The end of the stem is closed with a small cork stopper. The only other accessory equipment is a wash bottle. The ordinary laboratory wash bottle has been found to be too light to stand the rough usage it gets in the shop and in place of this a pint milk bottle is used fitted up in the usual manner.

The stem of the funnel is first filled with water and all air bubbles removed by means of a piece of straight wire. This procedure is necessary, otherwise the funnel will become clogged. The residue is then transferred from the screen to the funnel by use of the wash bottle. The residue will pass very rapidly from the cone down into the stem and when settlement is complete the percentage rejection can be read directly from the scale. If this is less than 1% the mill is discharged, if greater than 1% the cap is replaced and the grinding continued. The funnel is easily cleaned out by simply removing the stopper and allowing the material to drain into the pan which is provided for the purpose. The time required to make this test is less than three minutes.

In calibrating the scale it has been found advisable to have the distance between the one-tenth per cent divisions as great as possible to permit of rapid and accurate reading. When the percentages are calculated on the basis of a 300-gram sample the scale divisions are sufficiently large to provide for this and it is for this reason the 300-gram sample is used.

To calibrate the scale, a small quantity of coarse residue is accumulated and dried. From this three grams are accurately weighed out. This quantity then represents 1% of 300 grams. This is placed in the volumeter and allowed to settle for two minutes. The head of the column is then marked off. This height then represents 1%. This is divided into ten equal parts each of which represent one-tenth of one per cent. The scale can then be extended by means of dividers to any desired length or to conform to the length of the stem. When more than one funnel is to be used it will be necessary to calibrate each one separately as the variation in the inside diameters is quite considerable.

With this method no attempt is made to attain scientific accuracy but the results are sufficiently accurate for all practical purposes. Of course the residues from materials whose specific gravities are widely different could not be determined on the same scale but for materials such as flint, feldspar and glaze the results from one scale are accurate enough.

By George M. Darby:—The Dorr Company apparatus would have quite an application in the classification and dewatering of ground feldspar and considerable tests have been carried out at our Westport Mill to determine the sizes of units necessary for such separation and dewatering. We grind the feldspar wet and can easily make a classification at

200-, 300- or 350-mesh. The problem then is to dewater the fine feldspar.

The material is in a finely divided condition and will not settle readily. It is deflocculated, that is, dispersed. To coagulate or flocculate the solids requires some electrolyte.

After a large amount of research we have found that *lime* is the only electrolyte which has an appreciable effect. But the mere mention of the name *lime* to a ceramic engineer condemns its use as a coagulant. The amount we use is very small, an average of 5 pounds lime per ton of feldspar dewatered. The bulk of the lime is removed when the water is decanted, only a very small part of the lime remaining with the feldspar. For example: Assume a feed to a Dorr thickener to be 15 tons water, 1 ton of feldspar and 5 pounds of lime. The feldspar settles to a dilution of .5 to 1 (33% moisture). Then 14.5 tons of water have been decanted, and with it $\frac{14.5}{15} \times 5$ lbs. of lime in solution. Only $^1/_{30}$ of the original 5 lbs. of lime (or .17 lbs.) remains with the feldspar.

Figuring .17 lbs. of lime remaining with the feldspar it gives 0.0085% lime in the feldspar.

By George M. Darby:[1]—I appreciate your letter and "Colloquium on Feldspar." It gives us great satisfaction to have you voice the opinion that the slight additional amount of lime adsorbed from the flocculating agent would not be harmful.

This discussion definitely indicates the lack of uniformity in the prepared feldspar. In batch grinding or open circuit grinding one cannot hope to secure a uniform product. But in closed circuit grinding in which the material which has been ground to the desired fineness is being removed continually, and only the oversize is returned to the mill, a uniform product of a certain size is readily obtainable.

Dry grinding in conjunction with air or screen separation is more expensive than wet operation.

To produce a product finer than 100-, 200- or 300-mesh we would operate a bowl classifier in closed circuit with a tube mill or conical mill (grinding wet). The 100-, 200-mesh or 300-mesh feldspar would be overflowed to a thickener for dewatering (with slight addition of lime to assist flocculation and settling) and the feldspar coarser than 200-mesh or 300-mesh would be returned to the mill along with fresh feed for further grinding. The thickened feldspar would then be dewatered further on a continuous filter, and the filter cake fed to a dryer.

Reply to Mr. Darby by W. H. Landers:—Mr. Darby's comment on the necessity of providing a coagulant if feldspar is to be settled within a

[1] Received July 19, 1922.

reasonable time previous to or during dewatering, is borne out by actual milling operations.

Many careful observations of the action of very finely ground feldspar in water, have caused me to believe that fineness alone does not greatly retard the settling of feldspar, although it is quite apparent that the coarser the feldspar particle, the quicker it will settle.

The feldspar which fails to settle promptly, is not necessarily finer than that which settles within a reasonable period, but it has not been proven that the permanently suspended matter is altogether in a colloidal state.

Chemical analysis of the two materials does not indicate a conclusive difference.

Lime will coagulate all of the visible solids, and acts in other helpful ways during the process of wet grinding.

It cannot be used indiscriminately without causing some mechanical difficulties, but is so far, the best settling agent available.

In actual practice, a far less quantity than 5 pounds of lime per ton of feldspar dewatered, gives the desired result, and many chemical analyses made on both the raw feldspar and the finished product, show no more than a trace of CaO.

This small amount can have no influence on the subsequent use of the ground feldspar, especially when it is realized that many use lime to a more or less degree.

By O. O. Bowman, 2nd:—The subject of "Feldspar and Feldspar Grinding" is a very broad one and one that appeals to me very much. My interest in feldspar began when the matter of getting good, ground feldspar during the war times was practically impossible. Further than that, the price of the material was exceedingly high for the quality received. Therefore, we thought it would be advisable to go into the grinding of feldspar for our own use. I made a trip to Canada, visiting a number of mines in the Verona section of Ontario. Among the mines in this section and one that had the greatest reputation for producing some of the finest feldspar in Canada was the old Richardson Mine.

I was able to obtain enough feldspar for our own use. This feldspar was all bought as strictly No. 1 grade feldspar. All cobbing was to be done at the mines so that the material received at our plant was ready to be ground and no cobbing would be necessary. I was able to obtain a very good grade of feldspar at a price that would allow me to grind the material and have a finished product with a saving of about three to four dollars per ton. Had this feldspar cost me exactly the same as the ground feldspar, I would still feel that I was ahead of the game. The reason for this was that one saw the actual material that was used for the ground feldspar, knew the length of grinding time and could regulate the fineness to re-

quirement. If there was any trouble with the feldspar, it would be one's own fault. Further than that, by buying the crude feldspar, it was possible to carry a six months' supply and we often had as high as three hundred to three hundred and fifty tons of feldspar on the ground.

I must explain that we did not equip ourselves principally to grind feldspar. We already had a unit which was grinding a product for us but this unit was only running on a 50 per cent capacity inasmuch as our supply of the material did not warrant any larger production, so that by grinding feldspar, we cut down our overhead on this unit and the cost on our feldspar and the other material we were grinding. Our unit for grinding consisted of three chaser stones and two two-ton ball mills of Thropp manufacture. By running this unit 50 per cent on feldspar, we were able to produce enough ground feldspar for our daily use and keep a small stock.

As explained above, our method of grinding is not elaborate nor did we change anything for the grinding of feldspar, although I am satisfied that we can very well make a small change and save considerable in our grinding cost, such as by putting in a rock crusher and special conveyors. Our feldspar is first put under chaser stones where it is crushed and put through a $^1/_4$"-mesh screen. The tailings of this are put back under the stones and the product goes directly to ball mills and is ground for seven hours. Our product at end of seven hours gives us a feldspar equal to any feldspar purchased on the market today for fineness and quality.

I have visited a number of grinding plants. In the most efficient equipment, the Hardinge Mill is being used and from the information which I can obtain it is going to replace the intermittent mill in a number of places.

There is a great deal that can be said about the grinding of feldspar and inasmuch as we are not grinders of feldspar, I will leave it to the grinders to write their own discussions. However, the time is coming when the grinders have got to produce the quality and the manufacturer will have to pay the price for good material, but he is going to be willing to pay the price for the material provided he obtains what he is paying for.

By C. R. Moore:—The writer has followed with interest the various discussions on feldspar grinding and having investigated various grinding methods for reducing the material is making the following comments on the colloquium:

The answer to the first question by Mr. V. A. Stout that dry grinding can be performed as cheaply as wet is very reasonable but from a miller's standpoint the dry process has much in its favor. If it is advisable for efficient operation in dry grinding that the material be dry within one per cent of moisture, it is obviously cheaper to remove the 5% or 10% moisture from the incoming feldspar than to remove the 35% or 40% that has to be added for wet grinding.

This statement is based on the fact that the relative efficiency of a grinding unit wet and dry, while probably favoring the wet very slightly would be offset considerably by the increased cost of drying.

The logical method of drying the wet-mill product is by feeding it to a rotary continuous filter and removing as much moisture as possible by vacuum. This type of filter consists of a large wheel four to six feet in diameter and a face of from one to ten feet. The face or perimeter is covered with canvas and the wheel rotates in the slurry up to about one-third its height. Suction applied through pipes inside the wheel removes the moisture, the solids forming a cake on the perimeter which is removed by a scraper as the wheel rotates.

The moisture content of the cake is probably about 15%. This must then be conveyed to a drier for the removal of the remaining moisture. This drier, if of a continuous type which, of course is desirable, is liable to cause iron contamination which is objectionable.

There is a device on the market admirably adapted for this drying which would eliminate this iron. It consists of a woven wire belt mattress of the same width as the face of the filter. This belt rotates with the filter, on its face and the cake is built up in the mesh of the belt. The belt conveys the cake from the filter to the dryer, through which it is carried continuously until it is as dry as required.

The resulting cake is granular and dustless, readily disintegrates and yet is very convenient for handling.

These methods should be of interest to millers on account of this continuous action as compared to the intermittent action of filter presses, but their initial expense is high.

For the potter who produces his own feldspar, wet grinding should be desirable, especially if the incoming feldspar is fairly high in moisture, as drying can be omitted. In this case the finished feldspar can be pumped to agitators and measured wet. The solids per gallon are readily determined from the specific gravity of the slurry and solids. The effect of evaporation is small and can be readily corrected.

The objection to this method is the space required for storage and the constant need of agitation. If this agitation is as slow as possible iron and large grains of feldspar tend to settle and can be periodically removed which is quite an advantage. From the miller's standpoint, however, this method is out of the question on account of the shipping difficulties and to get the finished product in a dry state as cheaply as possible is his problem. Dry grinding, therefore, inasmuch as it omits the expensive drying operations, has much to recommend it to the miller.

In the opinion of the writer the grinding activities of large mining companies cannot be over emphasized in their relation to other grinding problems. The actual grinding of feldspar presents no difficulties that

have not been already surmounted by various mining companies and the results of their work are published freely.

With this fund of information at the disposal of millers it is more or less fool-hardy to duplicate expensive tests that have already been performed on ores similar to feldspar.

It has been proven many times that in a cylindrical tube mill of 22 feet in length, approximately 90% of the material is reduced to the required fineness in the first four or five feet of mill, the other seventeen or eighteen feet being necessary to reduce the remaining 10%. As the power used is in direct proportion to the length it is obvious that three or four times as much power is required to reduce 10% of the material as was needed for 90%.

This is due to the cushioning effect of the already ground material on the pebbles, making it difficult to concentrate a forceful blow on the coarser material.

In the case of batch mills the same action is apparent.

The biggest proportion of the mill charge is reduced to the required fineness in possibly less than a fourth of the total time required for the reducing of the whole charge. This is also because of the cushioning effect of the fine material.

The outcome of these tests has been the closed circuit system of grinding which is now standard in nearly all mining operations.

The mill length has been cut to about a fourth of its former size with a consequent large saving in power and the resulting cost per ton of ground ore is decidedly cheaper than with the old methods of open circuit grinding.

For fine grinding the short cylindrical or conical mills have replaced other types. The chaser mills are almost relics of the past where efficient operation is concerned.

The removal of impurities in the ore is a question of great concern to millers and undoubtedly this is difficult of solution in the case of quartz and mica except by hand packing.

Metallic impurities due to their high specific gravity can be removed by concentrating tables such as are used in mines, but quartz and mica do not lend themselves readily to this method on account of the similarity of their weight to that of feldspar.

There are on the market concentrating tables for both dry and wet processes so that use of a table does not compel one to adopt the wet method of grinding.

The copper sulphite, which Mr. Everett Townsend mentions as being evident in some of his feldspar, could be removed in this manner as also could iron sulphide.

For the benefit of those unfamiliar with concentrating tables a simple description would be of interest.

The wet tables are about 15 ft. long and 6 ft. wide. They are slightly inclined to one corner and receive a rapid vibratory motion in the direction of their length. The feed is at the high corner and due to the vibration the product is spread out over the surface. The heavier materials sink into grooves arranged lengthwise on the table and are discharged at the low end. The lighter materials overflow the grooves and are discharged at the side.

The dry concentrating tables operate on the same principle, except that the feed is made to flow by the introduction of low pressure air through a screen on the top of the table. Another device for dry concentration is the plumb pneumatic jig. This is a small machine 3½ inches wide and 24 to 36 inches long. The feed rests on a screen in a bed about 2 inches deep and this bed is caused to vibrate by pulsations of air from below. The heavier materials sink to the bottom and the lighter overflow at the top. The heavier particles are continuously removed by a simple device on the machine. The writer has had no opportunity of observing these dry machines in action but is of the opinion that they would perform their work satisfactorily and readily remove heavy impurities from feldspar.

Reply to Mr. Moore by W. H. Landers:—Mr. C. R. Moore has made some rather interesting comments on certain feldspar grinding problems. Most feldspar as received by the miller, even if wet by recent rains, does not contain over 2% of moisture. It is necessary to dry this to less than 1% before dry grinding, or more properly speaking, dry pulverizing can be satisfactorily carried on. This can be done mechanically in the case of large tonnages, or under drying sheds, where a comparatively small tonnage is handled daily. One very interesting situation has been noticed recently and that is that the so-called dry ground feldspar seldom contains less than 1% of moisture, and may reach 3% without its dampness being apparent. This added moisture is unquestionably obtained from the humidity of the atmosphere, as it is certain that it comes out of the mechanical dryer with far less than 1%, and yet when sampled in the car 24 hours after milling, has apparently taken up considerable moisture from some source.

A sample thoroughly dried and left on a scale pan over night, shows very definitely increased weight within 12 hours, particularly if the day happens to have been a very humid one. Actual practice demonstrates that from a milling standpoint, wet grinding is in every way preferable to dry grinding, when the former operation is thoroughly understood. Recent tests on a large conical mill gave an average monthly performance of 2.6 tons per hour when grinding dry, from 1-inch size to 50% through 150-mesh, and when grinding wet, a tonnage of over 6 tons per hour was reached without discovering what the ultimate capacity of this particular mill was. This difference would be even greater on the tube mills. It

is a very simple matter to reduce the moisture from wet mill pulp to less than 20% on the very fine sizes, but from that point on, drying is necessary; it can be satisfactorily and continuously performed at a very reasonable cost, and without danger of adding iron to the finished product.

The peculiar nature of the feldspar filter cake, however, very definitely limits the type of dryer to be employed. Wet grinding can best be employed, however, when it is desired to turn out a comparatively large tonnage, to make extremely fine sizes, or to purify the feldspar in process. As Mr. Moore states, the feldspar pulp can be used by the manufacturer in the form of slurry, without previous drying; that is what the British practice.

A method of storing wet pulp without constant agitation is possible and is practically used.

With respect to purification, quartz seems to be the only thing not now being substantially removed where the wet process is used.

By C. M. Franzheim:—I have read with a great deal of interest the various colloquiums and discussions issued this year on the subject of feldspar, and feel as though a great deal of good has been done in this discussion in bringing out the various weaknesses and strong points of the development of feldspar. By which I mean, the proper development of feldspar.

The problem of the preparation of the various grades of flints for the ceramic industry is fundamentally a grinding problem, but the preparation of feldspar for the ceramic industry is fundamentally a mining problem.

In the minds of ninety per cent of the feldspar-using trades they fail to recognize this fundamental fact.

The bulk of the cost of flint of the ordinary kind is in grinding. The bulk of the cost of most all feldspars is in labor, in the selection of the rock and the mining of it. The cost of grinding feldspar is, therefore, much smaller than the cost of the labor of the mining. Flint deposits and feldspar deposits have entirely different characteristics as a general rule.

Of course, were there to be found a feldspar deposit of any large size with practically pure feldspar, then it would be possible, not only to sell this feldspar almost as cheaply as flint, but that particular mine would then be a grinding problem and not a mining problem. Unfortunately, there are no such feldspar mines anywhere, hence all feldspar mines today are in the category of mining problems, and will remain so until such a large pure deposit of feldspar is found.

I have noted also in some of the recent discussions, the suggested advisability of feldspar specifications. We would welcome this, but it would be impossible for any set of specifications to be drawn up to be of any real practical or commercial value. Of course, it is possible to draw up a set

of specifications to suit all cases, but it would have to be so broad in its scope as to be practically valueless in the majority of individual requirements.

The reason why such a specification would not be practical, or have possible value is because of the different characteristics of the feldspar deposits located in the different fields. Unless the specification was general enough to take in all possible feldspar it would then be preferential, and preferential specifications could not possibly be of commercial value to the trades as a whole.

Canadian feldspars have some very fine characteristics for certain trades. Maine feldspars have very fine characteristics for certain trades, and other feldspars all have their own characteristics and may, or may not, be adapted to certain businesses, as the case may be.

The fact that a particular feldspar has a higher potash content, or a higher alkali content than some other feldspar does not mean that feldspar is far more valuable. It may be quite the reverse. It is the proper balance of the feldspar which counts and makes it valuable. Because of the high alkali contents of any feldspar the alumina content has such a bearing in helping maintain the balance that all the good of high potash may be lost by high alumina. Or, all the good of high potash and properly balanced alumina may be lost by black mica, high quartz or poor color. Feldspar mines which are operating today on a commercial basis may be inactive within the next ten years because even mines change or exhaust themselves. How then can specifications be drawn up for feldspar in a general way when specifications do not take into consideration, or cannot possibly do so, the very principal element of feldspar, namely its uniformity and constancy from year to year. This is the most difficult problem of feldspar producers in conjunction with careful mining. A feldspar which is properly balanced, and will only run uniform for a period of two or three months, although conforming to all specifications, is not a proper feldspar on a commercial basis, and the great value of feldspar is its uniformity from car to car, from month to month, and year to year, and any plant can become accustomed to any feldspar, regardless of specifications, provided that feldspar comes uniform from year to year. It is just as wrong for a feldspar producer to suddenly ship a pottery a car or two of excellent feldspar, much better than the last two cars, than it is to ship them feldspar which would be inferior to the last two cars, and greater loss on any pottery can be entailed by suddenly improving the quality of the feldspar without notice to them than a sudden lessening of the quality. If feldspar cannot be produced not only uniformly from month to month, but from year to year, then that feldspar is not a commercial grade. After all the uniformity of feldspar from year to year determines its real value, regardless of black speck, of potash content and of any other feature,

even price. Of course, all those items have some bearing, but in the end uniformity of the product is seventy per cent of the battle.

Naturally a feldspar producer does not want any more black speck, due to black mica or other foreign substance, in the feldspar than does the user, but he is required to accept the deposits as laid down by Providence, and there is not a commercial feldspar mine anywhere which does not contain these foreign substances. When one buys oranges he gets seeds, although it is possible to buy oranges without seeds. But as a rule, the oranges without seeds do not have the juice, and it is the juice that we are after. Is it not cheaper and best to buy oranges with the seeds and remove them, thus securing the greatest volume of juice? Of course, there are sometimes exceptions, and so are there exceptions with feldspar, but feldspar specifications which say there shall be no black speck are of no value because there is not one feldspar producer who can honestly fulfill same. And usually these exceptions are not feldspar offerings on a standard commercial basis.

Reply to Mr. Franzheim by W. H. Landers:—Mr. C. M. Franzheim's claim that the preparation of feldspar for the ceramic industry, is fundamentally a mining problem is quite justified, but there is no reason why the preparation of flints should not also be so classified. The greater proportion of flint used, and the consequent demand for a lower price has no doubt had some influence in getting the consumer to accept such flint as is offered without subjecting it to the critical discrimination with which he judges feldspar or other materials which appear on the surface of the finished ware.

The various clays appear as the result of a mining problem which the clay producer will insist is no less important than that of the feldspar miner.

The truth is that none of the rock products entering into the ceramic industry occur in such a pure state and in such large bodies that they have only to be considered from the "preparation for market" standpoint. Feldspar, as stated before, appearing as a finished material, and therefore subject to the scrutiny of the consumer, has come in for an amount of unjust criticism, and too much has been blamed on the feldspar, when the guilt should be shared by the other elements present.

It must not be overlooked that in England, a considerable quantity of material doing similar duty to our spar, is nothing more nor less than granite ground in water, and delivered wet in tank wagons to the potters and other users They get away with it, and succeed in turning out some very high grade porcelain ware.

They seem to be somewhat more critical of their clays. In this country, up to the present time, we have been skimming the cream so to speak, from extraordinarily pure and favorably located feldspar deposits, and it is

only as these are being mined out, that dissatisfaction has appeared in the ranks of the users of feldspar.

When it is desired to make any high grade finished product one of the prime requisites is to start with the best raw material obtainable.

The amount of impurities present in the crude, while being substantially reduced by subsequent operations, can seldom be completely eliminated.

It remains therefore, to establish as many standard specifications as possible, to enable both the miner and grinder of feldspar, to set a mark to shoot at; without these there can be no real advance towards improving or making more uniform, the quality of spar turned out by the grinders. Certain natural characteristics such as high or low fusing points, amount of alumina present or the ratios of the two alkalis, will always make feldspars from certain districts differ from those from other districts, and the time will probably never be reached, when the manufacturer can buy feldspar indiscriminately, with as little concern as he now buys gasoline to run his automobile. He may expect and demand uniform results from feldspars produced in each district. This will come more from improved milling and purification methods, than it will from the unsatisfactory and costly selective mining methods now so generally practiced.

When it is realized that most of the objectionable impurities, with the exception of quartz, are present in only small fractions of a per cent, even in the granites or very low grade spars the question of milling or the preparation of a satisfactory product for market, cannot help but become of prime importance. So-called second grade feldspars can be made into a very satisfactory, high grade product by methods now available, but it will be necessary to have certain standards established before these improvements can be generally adopted. Mr. Franzheim stresses the importance of uniformity, but he must realize that there can be little hope of uniformity, so long as the present milling practices are indulged in. Old customs die hard, and competition is their most ruthless destroyer.

GLASS INDUSTRY IN INDIA[1]

By G. P. Ogale

The word "kanch" (glass) is found mentioned very often in old Sanskrit literature during the last two thousand years, signifying the knowledge of glass-making among the ancient Hindus, although adequate records are not available as regards its manufacture, nor have ancient samples and relics been systematically preserved. Glazed tiles were used for flooring and wall decorations even in the twelfth and thirteenth centuries and samples of this kind of work can be seen on buildings of that period. The manufacture of glass bangles (bracelets) and beads was practiced in very ancient

[1] Received March 10, 1921.

times and the authentic existence of these can be traced as far back as the last six hundred years. These were made in the province of Agra and Oudh in the north, in the province of Gujrat and in a few places in the south.

The glass was melted in small clay pots on wood or charcoal fire, and the bangles were made by gathering a small quantity of glass at the end of a small steel rod, and turning the rod by hand and expanding the soft bead of glass into a ring, which was afterwards placed on a clay cone and further expanded to proper size. Even today the demand for these bangles is met by a system of indigenous household industry. Every Indian woman wears at least two or three bangles round her wrist and these form a necessary ornament of a married woman.

There are at present many factories in India on modern scale, turning out hundreds of tons of colored glass in order to supply the demand of the bangle makers, who buy it in the form of cakes or blocks and remelt it in their small furnaces and make bangles. Formerly these people made their own glass, but now prefer to buy it from factories. The household industry also produces small vials, lamps and perfume bottles, but these are very inferior in quality.

Glass factories on modern scale date back only to the last fifty years or so. They were organized with Indian capital but were generally managed by Austrian or German experts. The history of these factories has been one of continuous struggle against various difficulties. The greatest difficulty was to get proper technical help. The training of local labor also had to be arranged for. The so-called experts were in some cases mere adventurers, who worked only during the construction of the factory and bade good-bye even before starting work. Another man who was recruited in his place probably condemned the work done by his predecessors and construction had to be substantially altered.

The experts were not generally willing to train Indian workmen, and in some cases, where they were willing, the proprietors of the factory would not stand the expense of training the labor and waiting until it started paying back. The people who put in their money invested it more from patriotic enthusiasm than from a purely business motive. The lack of technical knowledge on the part of the promoters was a standing obstacle in the progress of the factories and the industry in general.

Then again, the high temperature during the summer months caused many of the European experts to quit their jobs and no adequate arrangement of cooling by artificial means was adopted in any factory. This caused slackness even among the Indian workmen and plants had to be shut down during the hot season.

If Indian works could adopt the air circulation system as is used in this country, the factories could be worked all the year round.

One great cause of the failure in all these factories was the want of government protection or direct help, especially in the beginning, against outside competition. India, owing to her peculiar political situation, has been unfortunately a dumping ground for foreign manufactured goods and unless a system or protective tariff is devised to safeguard industries within her own borders, she will continue to be the happy hunting ground of foreign adventurers to her own detriment.

To fight certain of the causes, the public made an attempt in a new direction. They raised a fund called a "penny fund" and opened a glass school at Talegaon near Bombay about fifteen years ago. The management of this school was placed in the hands of Mr. Ishwardas Varshnei, who had gained his experience in the United States and in Japan. He started with a small direct-fired pot-furnace with the help of Japanese blowers, and took a few Hindu boys for training as blowers. In a few years a good number of hands were trained as blowers, and the plan worked quite well—so much so that the boys are now running the school factory on a profitable basis, while Mr. Varshnei is running three or four factories in the Punjab. He is now trying to put his factories on a most up-to-date scale and is soon to add a window-glass plant to his list. A dozen other factories have been started by the students of the Talegaon school, and are making a steady progress.

The goods turned out at present in the Indian factories are lamp chimneys and globes, tumblers, pressed-ware and bottles. No doubt, the factories working at present are on a small scale and do not supply even a tenth of the demand. Yet they have inspired confidence among the capitalists and big plants are soon to be expected on most modern lines.

Though India abounds in raw materials for the glass industry, these have not as yet been properly investigated. There are good sand deposits in the north, in Gujrat and in the Mysore and Madras presidency. Besides there is plenty of soft sandstone and quartz distributed all over. There is a suitable supply of limestone also well distributed. India produces the largest quantities of manganese in the world. Nitre is produced in the United Provinces. Soda, from the Reh deposits and also from the lakes in Rajputana and Central Provinces is awaiting investigation. At present English soda is largely used. The fuel used is bituminous coal from Bengal and the Central Provinces. Wood is used in two or three factories.

India imports about eight million dollars worth of glass every year from various countries such as England, France, Belgium, Germany, Austria, Japan and the United States. Before the war Austria Hungary ranked first on account of its sales of glass bangles and also took a prominent part in the trade of lamp chimneys. Among exports from Germany were bottles, lamp glasses, and false pearls. The United Kingdom monopolized

the trade in soda bottles and also exported in large quantities bottles and vials, sheet and plate glass and tableware.

The supplies from Belgium consisted of lamp chimneys, pressed tumblers and window-glass.

Japan today holds a very prominent position in her exports of glass to India and has generally taken the place of Germany, Austria and Belgium during war time and is trying to maintain her predominance in the market. The quality of Japanese goods is improving remarkably and Japan has her own methods of underselling.

Owing to the more extended use of glass, the imports of glass in India are constantly increasing in spite of the local manufacture.

Ogale Glass Works, Ltd.
Ogalwadi Oundh State
Dist. Stara, India

DISCUSSION[1] ON "THE PRODUCTS OF THE CALCINATION OF FLINT AND CHALCEDONY"[2]

By C. N. Fenner:—In the September number of this *Journal* Washburn and Navias present the results of their study of flint and chalcedony. I should like to offer some discussion of certain parts of their conclusions. These parts are embraced in the following summary of their views (page 581): "(1) Flint and chalcedony consist of colloidal quartz. In the purer forms of chalcedony the colloid is of the gel type and the individual colloidal particles are microscopic or sub-microscopic in size. Fenner found that when chalcedony was heated in contact with a flux at 800°, 'quartz' and tridymite were produced. The 'quartz,' *i. e.*, macrocrystalline quartz, is evidently the result of the recrystallization of the colloidal crystals, and quartz is, of course, the stable form at this temperature. The simultaneous appearance of the metastable tridymite under such conditions is a common phenomenon..... (4) Fenner made a thermal analysis of raw chalcedony over the quartz α-β inversion temperature and failed to find any heat effect indicating an inversion at this temperature. It was largely because of this negative result that he concluded that chalcedony could not be classified as quartz. Now it is altogether probable that both the inversion temperature and the heat of inversion of a quartz crystal vary markedly with the size of the crystal, for crystals of colloidal dimensions. Consequently, according to our theory of the nature of raw chalcedony, we might expect that the quartz inversion would be spread over a considerable range of temperature owing to the varying sizes of particles present, and this inversion might, therefore, easily fail to be detected by the method of thermal analysis."

[1] Recd. Sept. 16, 1922.

[2] Washburn and Navias, *Jour. Amer. Ceram. Soc.*, **5**, 565(1922).

In this explanation the idea of colloidal quartz plays an important part; in fact, the whole theory may be said to rest upon it. By this term I understand that what is meant is silica particles in each of which the atoms are oriented according to the crystal pattern of quartz, but of such minute dimensions individually that surface forces play an important rôle with regard to their environment, and their free energy is thereby considerably increased.

Now I have no objection to offer on theoretical grounds to the idea that quartz particles might be reduced mechanically to such an extreme state of fineness, or might under some circumstances be formed that way in nature, but I think there might be room for question as to whether the natural deposition of quartz from solution in such minute particles under the conditions that give rise to chalcedony, would be probable. This phase of the question, however, is one on which I would bear very lightly because definite data are lacking; but there is another on which one may speak with more confidence. Chalcedony is not a satisfactory material for microscopic study, but that is largely due to its fibers intermeshing in such a way that aggregate optical effects are likely to be obtained. The individual fibers are rather small units, but usually large enough so that the optical character of their elongation may be obtained, and I should suppose that there is a world of difference between units of this size and those approaching molecular dimensions, where surface forces would be an important factor.

The explanation of Washburn and Navias would require that the grains of their colloidal quartz should be so infinitesimal that its free energy would be greater than that of tridymite, for evidently that is the basis of their explanation of the appearance of tridymite in those experiments of mine in which chalcedony was heated with sodium tungstate at 800°. They say that "the appearance of the metastable tridymite under such conditions is a common phenomenon." I should be glad to have examples of this given, as I am not familiar with anything that seems closely comparable.

The foregoing remarks indicate the points of their theory that seem to me not entirely convincing. On the other hand, the evidence supplied by the X-ray crystal spectra that they reproduce seems to show quite definitely that the material they worked with contained quartz. There are two possibilities that occur to me by which the apparently conflicting evidence might be harmonized.[1] One of these is implied in the paper to which Washburn and Navias have made reference.[2] There I suggest that chalcedony may be a mixture of quartz and some other form of silica

[1] There is nothing essentially new in either of these suggestions.

[2] C. N. Fenner, "The Stability Relations of the Silica Minerals," *Am. J. Sci.*, 36, p. 380.

(presumably amorphous silica). The presence of the amorphous silica would account for the formation of tridymite at 800°, and would tend to blur the evidence of the α-β inversion so that it might not be recognizable. The objection I have felt to this explanation is that it implies the presence of such an amount of amorphous silica that, as I thought, it should have been recognizable microscopically, but I am open to conviction on this point.[1]

The second possibility is that one sample of chalcedony may differ from another in its constitution, and that the superficial resemblance is misleading. In that case different investigators may have worked on different substances. Some basis for this idea may be supposed to be found in the existence of the various similar substances known as quartzine, lutecine, and lussatite which have been described.[2]

The essence of the foregoing may be stated in a few words. Washburn and Navias have presented evidence to show that some chalcedony at least contains crystalline quartz, and this is a distinct contribution to our knowledge of the subject, but the theory of colloidal crystals that they offer in order to bring this into harmony with apparently contradictory results obtained by others does not seem altogether satisfactory, and further evidence is desirable before the problem can be considered settled.

Geophysical Laboratory
Carnegie Institution of Washington
Sept. 12, 1922

Reply by E. W. Washburn:[3]—Dr. Fenner's viewpoint regarding the constitution of chalcedony is not essentially different from the one proposed by us. He suggests that the chalcedony, in addition to containing very small quartz crystals, also may contain amorphous silica. According to our theory of the colloidal constitution of the mineral, it would be formed by the deposition of colloidal quartz made up of exceedingly small crystals of varying sizes. The smaller of these crystals would probably be somewhat ill-formed and would shade off gradually into a material in which the crystalline form was so ill-defined that it might be more properly called amorphous, so that we would have all gradations from some particles practically lacking in crystalline form up through ill-formed crystalline particles to larger and more perfectly formed quartz crystals.

Our remark in citing the appearance of tridymite as an example of a common phenomenon referred merely to the well-known frequent appearance of a metastable phase from a solution saturated with respect to a more stable phase. A solution saturated with respect to quartz, such as

[1] With regard to the possible existence of such a mixture, see H. Leitmeier in article "Chalcedon" in Doelter's Handbuch der Chemie, Bd. 2, erst Hälfte, page 166.

[2] H. Leitmeier, *loc. cit.*, page 165.

[3] Received Sept. 27, 1922.

the one obtained in Dr. Fenner's experiment at 800°, might also be saturated with respect to tridymite. As Dr. Fenner points out, this would of course, necessitate that some of the colloidal particles of the chalcedony would have to be small enough so that they would have a greater free energy than macroscopic tridymite crystals.

As suggested in our paper, it would be interesting to determine the volume change of chalcedony over the quartz α-β inversion temperature. This might give some indication of the amount of crystalline quartz present in the mineral, although here again the volume change on inversion might be expected to vary somewhat with the size of the crystal. For such an experiment it would be necessary first to dry the chalcedony in vacuo at a temperature below that at which inversion could occur.

DISCUSSION ON "NOTES ON SHIVERING OF TERRA COTTA"[1]

E. C. Hill:—I should like to ask Mr. Carruthers, whether he found increased shivering on aging or weathering of these trials. It is well established that crazing increases on weathering, but I have not noticed any further development of shivering on weathering.

In a series of trials I made, using various clays and grog, shivering developed on one trial of a Georgia kaolin body. The same series included a very sandy clay, which developed crazing. From Mr. Carruthers' results, we should expect the sandy clay to develop shivering instead of crazing. The shivering on the Georgia kaolin body might be a form of "peeling," however, since this body is very porous.

Mr. Carruthers:—Our experience with shivering has led us to believe that its tendency is always present under certain conditions. Lines of strain will show in ware taken hot from the kiln which will open up later. These lines show where shivering has taken place in the kiln. We have had a number of shivered samples out on the roof of the plant for four years and on which the shivering has not increased.

Mr. Hottinger:—I wish to call to your attention the fact that in the use of fine silica, the finer you grind the silica the more of it your glaze will take. That is shown very clearly in Mr. Carruther's exhibit. Shivering will be found with the fine silica while with the same content of silica, but coarse, the tendency to shiver will be less.

You might say that the fine silica dissolved by the glaze changes its coefficient causing shivering, whereas with the Georgia clay which is free from silica you have just the opposite. That is, the glaze dissolves clay substance very slowly and if the glaze was not absolutely fitted to the body, the body being very weak, you would be liable to run into shivering. I think that is one explanation, possibly, of the point that you brought out.

[1] J. L. Carruthers, *Jour. Amer. Ceram. Soc.*, 5, 518 (1922).

MR. C. W. HILL:—Mr. Carruthers' paper contains many interesting points which doubtless will be of value to others in suggesting the direction in which to go in correcting trouble from shivering. Since the bodies and glazes used by different manufacturers differ widely in properties it is probably unsafe to generalize on the results obtained with specific bodies and a single glaze. Mr. Carruthers very wisely qualifies many statements as referring to his particular conditions.

It is perhaps indicative of the present state of knowledge and methods that this paper like many others deals largely in qualitative tests. It would seem desirable for all of us to attempt to work down to fundamentals. There is, of course, a physical basis for the phenomena observed. Shivering is usually attributed to difference in thermal expansion of the body and the glaze ("poor fit"). Assuming this to be the case it would make such investigations more valuable from a general standpoint if the changes in composition were tied up with determined changes in physical properties such as the coefficient of expansion. With the Bureau of Standards equipped to handle such tests it would seem a comparatively simple matter to secure such data. The science of our industry can be advanced more rapidly by more rigorous methods in our research and as a Society we should, I think, urge upon all contributors to our Journals the necessity for more quantitative physical data along with the qualitative practical tests.

Mr. Carruthers' data would doubtless be of more value to others if he had included the results of common tests generally in use on the clays and bodies (*e. g.*, *clays*—dry and burned shrinkage, porosity, mechanical analysis, *bodies*—absorption, density, coefficient of expansion).

It is doubtful whether it is correct to include under shivering the result of incorrect glaze fit and that of poor tenacity resulting from soluble salts. In many cases it is possible to differentiate between the two effects by observation, one being termed shivering and the other glaze peeling.

Mr. Carruthers' figures on the effect of addition of soluble salts are difficult of interpretation since the amount and kind of soluble salts already in the body are not given. The total amount of salt required to give peeling would be valuable information.

The use of felsite commercially is very interesting from a practical standpoint as well as from its connection with the work of others on fluxes in terra cotta bodies. It is unfortunate again that Mr. Carruthers has been content to let his investigation rest with the qualitative results. Mr. Carruthers questions whether the felsite has an effect on expansion but does not test the point. Obviously if our usual explanation of shivering is correct it must change the expansion. This should be determined as it is the most valuable point in the whole matter. Having determined that the expansion is changed by the flux it is also very important to know how this is effected. From the microscopic examination of Body 6

(Table V) the indication is that the felsite does not attack the free silica but forms a bond around the quartz grains. The effect of felsite on other properties than expansion should also be stated such as green and burned shrinkage, density and porosity.

Mr. Carruthers deals with a subject of general interest and touches on many important points. Anyone in commercial work can understand the difficulties which prevent the complete investigation of a subject and which often result in the reporting of an investigation more as a specific factory problem than as a piece of fundamental research permitting general application. It is to be hoped that as time permits Mr. Carruthers will fill out the work with the tests and data indicated and thus make a noteworthy contribution to the literature of our industry.

Mr. Carruthers:—As Mr. Hottinger and Mr. C. W. Hill have both stated, shivering is purely a local trouble, due to the body and glaze not being properly fitted together. However, we have had the body and glazes properly fitted and then almost over night, shivering would occur This we have traced to the action of excess fine silica occurring in the clay or grog. This change in the body composition will take place without any physical difference being noted in the raw body.

For a number of years, the method of overcoming the trouble, was to fit the glazes to the changed body. Now, we find it more practical to fit the body to the glazes. This is accomplished by the use of a flux such as felsite. It has made the body more safe, *i. e.*, variations in the amount of silica present in the clay or grog are taken care of and shivering troubles eliminated.

DISCUSSION[1] ON "DATA ON VISCOSITY OF INDIANA CLAY SLIP WITH ELECTROLYTES IN REGARD TO THE CASTING OF TERRA COTTA"[2]

By R. L. Clare:—Casting of terra cotta appears to be a logical method of forming small pieces of intricate, or highly ornamented shapes. This includes balusters, rosettes, small gargoyles, small brackets and other small ornamental pieces. Pieces, such as these, do not necessarily have to have a thick wall and their shape lends itself to casting. Pieces such as these also are difficult to press without making them nearly solid, and consequently they are much more liable to spalling, cracking, etc. The splitting of balusters where they are joined would also be eliminated by casting.

Large material, such as ashlar pieces, or other running pieces requiring partitions and thicker surfaces, do not lend themselves quite so readily to

[1] Received Sept. 21, 1922.

[2] H. E. Davis, *Jour. Amer. Ceram. Soc.*, 5, 702 (1922).

casting, and the question of speed of production, cost of moulds, etc., makes it questionable as to its economic possibility.

The difficulties we encountered in casting were that the changes in the clay made it necessary for us to change the proportion of electrolyte constantly, and that a proper electrolyte for the clay one month was not satisfactory the next. This we attributed to a difference in the soluble salts in the clays received. We used both sodium carbonate and sodium silicate and found that a mixture of the two gave the best results.

DISCUSSION ON "AN ACCOUNT OF AN INVESTIGATION OF SOME GEORGIA CLAYS AND BAUXITES"[1]

By W. C. Woodall:—May I say a word of sincere appreciation of the enterprise and friendly interest of *The Journal of the American Ceramic Society* in publishing in its September issue the clear and comprehensive article by Messrs. Gilmore and Fessler relative to the tests of Georgia clays now being made at the Ceramic Station at Columbus, Ohio. The article bears evidence of thorough investigation of this subject, and the publicity thus given this phase of industry in Georgia will beyond doubt hasten the development of the clay and bauxite deposits in the state.

Vast as are the clay deposits of Georgia, the ignorance that has prevailed regarding the ceramic possibilities of this tremendous mass of material, its availability as pottery material and as refractories, has been almost as vast. Today, the first thorough investigation of this material, the first complete, scientific test, is being made. It is interesting to note that this important step was taken at the instance of a progressive railway company which believes in intelligent coöperative effort in the development of the country it serves.

The Central of Georgia Railway, having the largest Georgia mileage of any railroad system has keen realization of the responsibility that this entails and has taken active part in state development work.

Under these conditions, an authoritative investigation of one of the state's greatest natural resources, and its possibilities for refinement and utilization is peculiarly timely. It is the earnest desire of Georgians to witness the development to utilize to the fullest extent the resources of their state by capital from abroad. With the middle belt of the state practically a clay bed, a source of tremendous wealth—an industry that will provide employment for many thousands, that will give capital to another safe and profitable field of development—is indicated. The clay industry should become one of the chief enterprises of Georgia.

The Industrial Index
Columbus, Ga

[1] Gilmore and Fessler, *Jour. Amer. Ceram. Soc.* (*Bull*)., **5**, 193 (1922).

DISCUSSION ON "WET PROCESS ENAMELS FOR CAST IRON"[1]

By J. E. Hansen:[2]—This paper is an especially valuable contribution both to the literature and to the enameling industry, not only because of the fact that it is the first contribution of its kind, but because of the extensive scope of the investigation reported. However, to justify the excellent results obtained by other wet process enamels already in use on cast iron, and not to lead to misapprehensions on the part of future investigators, it should be borne in mind that some of the conclusions reached are true only on enamels of the particular type under discussion and may not apply to all types; for instance, the limit as given for sodium oxide in a sintered ground coat may safely be exceeded in a ground coat of the melted type. Also it is known that certain types of a melted ground coat, with suitable mill additions, are highly successful and may give even greater strength and adherence than those of the sintered type.

The observations and experience of the writer check in general the statements of the authors of this paper. It has clearly been the experience of the writer that the fusion point of ground coats and cover enamels should bear a close relation to each other, and that, if the composition is correct, the cover enamel can be burned at the same temperature or even a slightly higher temperature than the ground coat.

The writer believes that many cases of pinholing in cover enamels can be traced to the lack of such a close relationship in the fusion points of the respective coats and to overburning of the cover enamel.

The writer does not, however, agree with the authors, in their statement that the crawling of high boric oxide enamels is due to the higher viscosity imparted by an excessive amount of that oxide, but believes rather that it is due to the dissolved salts of boric acid which, crystallized from the aqueous suspension of the frit, give up their water of crystallization as the enamel is fired, and by their swelling cause crawling.

The crawling of enamels high in cryolite may possibly be explained by the high viscosity and high surface tension of enamels rich in aluminum compounds, in this case aluminum fluoride. The same effect can be developed in an enamel to which a large amount of aluminum oxide or hydrate is added.

The writer believes that while the enamel composition is undoubtedly of greatest importance, almost as significant factors in the successful enameling of cast iron by the wet process are the manipulation of the enamel and the nature of the cast iron to be enameled.

By W. C. Lindemann:[3]—In checking over the work done by Mr. R. R.

[1] Danielson and Reinecker, *Jour. Amer. Ceram. Soc.*, **5**, 647 (1922).

[2] Sept. 8, 1922.

[3] Recd. September 16, 1922.

Danielson on wet cast iron enamel, all such enamels both in ground coat and cover coat that seem practicable, were tried out on a commercial basis in our enameling plant. The enamels were smelted in commercial batches and the ground coats were fritted, the batches for cover coat being 450 lbs. to a smelt, and the ground coat batches fritted were 125 lbs. to a batch. They were then milled in the usual mill batches varying from 100 to 250 lbs. to a mill. Mill additions were made as shown in the formulas submitted by Mr. Danielson.

The results in general checked the results shown in the laboratory. However, in using the wet cast iron enamel, the actual operation of coating and burning a piece, is of such importance that absolute information cannot be given on any trials until all the operators have been accustomed to the use of any one particular enamel. In this respect, the checking up of one batch of smelted enamel is hardly sufficient to give a definite check on laboratory results although if the results are very bad, one batch is sufficient to show whether the enamel is commercially practicable or not. When the enamel is nearly right, small defects as may appear cannot be attributed directly either to the enamel or the operation, and indefinite results are obtained.

However, in the trials such enamels as proved very bad were immediately dropped from consideration and such other enamels as proved fair were retried on further smelts until a reasonably accurate decision could be given on the same.

The results obtained do not entirely check with the summary given by Mr. Danielson. The ground coats that gave the best results were as follow in the order named: Rg 7, Rg 1 and Rg 26. Ground coats Rg 17, 25 and 18 as mentioned by Mr. Danielson were not practicable on continuous use causing various defects in the final enamel which could not be overcome. On the other hand, Mr. Danielson does not mention Rg 7, which seemed to give uniformly good results on all trials.

Regarding the cover coat, the results show that R1 seemed to be the best for general purposes with R14 and R11 as reasonably good enamels. However, R 28 and R18 as mentioned did not give satisfactory results, R 28 not having sufficient covering capacity and R18 being the same way. Both R 28 and R18 if covered heavily, would cause crawling to such an extent that the pieces would be unusable.

There is a very marked difference in using certain cover coats for certain ground coats and this is especially noticeable on wet cast iron work.

The ground coats and cover coats given above, all seem to work reasonably well together using any one of the ground coats with any one of the cover coats, but the best combination seemed to be as a final check-up, the use of Rg 7 as a ground coat with R1 as a finish coat. However, precaution was necessary on the use of these enamels since the Rg 7 was

rather sensitive on firing and if over-burnt caused cracking in the finish enamel and when under-fired, caused blistering. However, if this ground coat was burnt properly, good results could be uniformly expected. In addition, when using Rg 7 as a ground coat, there were less black spots appeared in the white or finish coat than on any other enamels tried in the entire series. This is an important item since there are very few enamels in wet cast iron work when using a white finish coat where black spots are not noticeable.

By M. E. Manson:—Probably every enameler who reads Messrs. Danielson and Reinecker's paper will find that at certain points their findings are radically different from his own experience. Near the end of the paper, the authors state:

> The fact that cryolite had vastly different effects in the two different types of basic enamels, shows rather definitely that a broad statement cannot be made as to its effect in different types of composition.

I believe that this statement could be enlarged to include not only cryolite, but every ingredient of the enamel.

To the sanitary ware manufacturer, using the dry process of enameling, wet enameling is apt to be of merely academic interest. Nevertheless he has many small pieces, which it would be entirely possible to enamel by the wet process at a great financial saving.

At our plant here we have done a small amount of experimental work on this subject, which has in some features borne out Mr. Danielson's work and in others has not. We found that the degree of smelting the ground coat was of great importance. I even know of one formula, which when mixed raw in a mill, gave very good results. When sintered, and ground, and covered with the same cover coat, it blistered badly. With the particular ground coat which was the basis of most of our experiments, we found that the addition of 15 to 20% of clay in the mill gave best results. Our greatest trouble with this series was blistering of the cover coat. By adding 20% of clay in the mill, and softening the frit accordingly, we did away with the blisters, but the cover enamel was still full of what Danielson calls "incipient pinholes." They look like skin pores, and are present in nearly every piece of wet enameled cast iron I have ever seen.

The further modification of this formula, by reducing lead oxide from 8 to 3% and raising borax proportionately, gave us a successful wet enamel. Test pieces made from this were uniformly good, with very few pores. A hundred pound batch, used on regular factory pieces was fairly successful, but required very careful burning. This substitution of borax for lead oxide had exactly the opposite effect from that observed by Mr. Danielson.

There are many factors affecting a wet enamel besides the enamel composition. A ground coat which will give good results when burned at 1500 degrees will be a failure at 1700 degrees. If the pieces to be enameled will not warp at 1700 degrees an enamel should be developed which will work at that temperature, for production will be higher.

The composition of the iron is an important factor. Formulas which give good results at one foundry, will frequently give miserable results on iron from another foundry.

Still another factor is the thickness of the ground coat. Our ground coat for dry enameling is applied in a very thin coat. I have seen wet enamelers apply what they considered a thin ground, which was nearly twice as thick as ours. It sometimes happens that a ground coat can be made to give much better results if a thinner coating is used.

The above observations are from the small amount of work done here on this subject. As I said before, a good wet enamel was not of such vital interest to us. The most surprising thing in our whole series of experiments was the result we obtained with our own dry process enamel. We used our regular ground coat. We took our regular white coat, ground it with water, 6% clay, and 8% tin oxide, and used it as a cover, and this gave us the best results we have had. This may be only an exceptional case. Nevertheless I would like to know what results could be obtained by the other sanitary ware enamelers, using their composition as a wet enamel.

This whole subject, in spite of the rapid progress it has made is still in its infancy, with much work remaining to be done. Mr. Danielson's excellent paper, however, goes a long way toward the goal of a good wet enamel for cast iron.

Reply to Mr. Hansen by Mr. Danielson:—While we have recommended the "sintering" of all ground coats in this investigation, this is not to be interpreted as meaning that all compositions are of the usual sintered type, that is having a dull refractory finish when fired on the casting. The majority of the ground coats can be fired to a semi-glassy finish. However, we have found that the sintering method results in ground coats possessing more satisfactory adherence to the castings. Almost invariably adherence has been improved by the undersmelting of the ground coat.

We are inclined to disagree with Mr. Hansen that the crawling of the enamels high in boric oxide is due to the dissolved salts of boric acid rather than to the viscosity imparted by excess boric oxide. Enamels of this type are very viscous even in the smelting and the same phenomenon has been noted in enamels for sheet steel. While the soluble salts may tend to cause cracking in extreme cases, we cannot believe that this action alone

would cause crawling on enamels fired as slowly as the enamels applied on castings.

Reply to Mr. Manson by Mr. Danielson:—The various factors aside from enamel composition mentioned by Mr. Manson undoubtedly have an important bearing on the results to be obtained with enamels of the wet process type, but the same conditions are encountered in practically any type of enameling. As a result of our experiments we question, however, whether enamels maturing at 1700°F are practicable for wet process enameling on cast iron. At this temperature we believe there would be a tendency for the surface of the enamel to gloss over in the early stages of the firing, tending to entrap gases held in the castings, with blistering of the enamel as a result.

While certain dry process enamels do give good results when used by the wet process, as stated by Mr. Manson, our results in the application of dry process enamels to this method clearly show that this is not true in all cases and that very unsatisfactory results can be expected with certain other types.

Reply to Mr. Lindemann by Mr. Danielson:—Mr. Lindemann's discussion is of value because it not only gives additional concrete information, but also because it raises the question of the proper use of laboratory results in improving manufacturing processes. It is well to emphasize the fact that a laboratory investigation of this kind is designed to develop information regarding the technic and the probable limits of composition as well as the effect of varying constituents in the compositions in order that defects may be corrected.

Mr. Lindemann's statement, that the various operators must become familiar with the preparation and application of a certain enamel to obtain best results, is very true. Enamel compositions developed in this as well as other investigations have given satisfactory results in some plants, while in others the reverse has been true, due undoubtedly to variations in technic encountered in the several plants. While the development in the laboratory of enamels applicable to all factory conditions is desirable, it is not to be presumed that all compositions so developed will prove practicable without their modification along lines suggested by the results of the systematic laboratory investigation.

Additional light can perhaps be thrown on the seeming discrepancies between the author's summary and Mr. Lindemann's experience by the following notes:

From the results of the preliminary work done at Mr. Lindemann's plant, Rg-7 was reported as having a comparatively short firing range and it was for that reason that it was not included in the list of the more promis-

ing compositions. Evidently Mr. Lindemann's operator is skilful enough to use it successfully, showing that we were playing over-safe in excluding it from the list of desirable enamels.

From our knowledge of these compositions it seems probable that Mr. Lindemann's objection to the cover enamels R-28 and R-18 was lack of opacity. These covers are more particularly adapted to those factory conditions, which are not uncommon, which make it desirable to use a cover which will cover satisfactorily in all cases even though it is necessary to apply several coats in order to attain sufficient opacity. Several compositions with particularly good texture and burning range but somewhat low in opacity were included to meet such conditions, and by no means should these be excluded from a field of commercially usable enamels.

WATER COOLING OF GLASS TANKS[1]

MR. PAYNE:—We have been very much interested in the subject of water cooling. About a year and a half ago we obtained a list of the companies having water coolers on their tanks. Included in that list were about fifteen different concerns. We sent out a questionnaire and in almost all cases I received answers. I will say that about ten of the companies replied that they had them in for a short time, but were unable to get definite results at the time of writing. About three or four of the companies were very enthusiastic about their use. Two were really noncommital or adverse to them. In those cases it seemed that the question of the purity of the water was a great factor. The real question, however, is whether 18- or 24-inch water coolers are desirable.

THE CHAIRMAN:—What contact do you have between the refractory and the metal container?

MR. PAYNE:—Simply a ground surface. We use no cement.

THE CHAIRMAN:—How long have they been in operation?

MR. PAYNE:—About a year. We are not saying very much about it, but they are a little better than the old style.

THE CHAIRMAN:—Has anyone else any experience with water coolers?

MR. YUNG:—I don't know, but I think that I was one of the first to start the water cooling proposition in glass house tanks. I might give you a little idea of the way the thing developed, and how disappointed I was at the finish. In the first place, we had a very corrosive glass, and the life of the tank was very short. I conceived what I thought a very brilliant idea one time of making a repair on the tank. The box was eaten through in spots, and it had been the practice of the men in the factory to pack this hot spot with the block, and the block on there would

[1] Glass Division, St. Louis Meeting, March 1, 1922.

overheat this particular spot. The glass came through, and I thought I had a wonderful scheme. By means of a piece of sheet iron I could distribute the heat developed on that particular spot over a larger area, the iron being a good conductor, and conduct the heat away from this hot spot. I tried that out and it worked very satisfactorily in sections over twelve inches square, and where the hot spot was perhaps five or six inches in diameter. On this water was turned, and the plate acted as no protection against the water. That held the tank with those holes in it, for a matter of six months, with these steel plates and the weak spot. And after that it looked so good, we tried the whole rear end of the tank with the sheet metal, covered it and pressed it up against the tank block as closely as possible, and put an extra underneath it to gauge the flow of water; in six weeks, as I remember, the whole melting end of our tank was eaten out. Then we made a hot repair and replaced the whole rear end of this tank and in the meantime with the hope of the thing being successful I had gone into the water jacket of the cooler. That happened to be installed before the development of this sheet on the back of the tank. These coolers were installed in short order. I think it was three or four months—and this tank went out. Considerable investigation was made of the blocks with accurate instruments, and it was readily seen by observation, whenever there was an opportunity of looking down between the water cooler jacket and the place. You could see the heat throughout the entire length of the furnace showing that instead of the blocks running cooler with the water jacket on it, they ran hotter, the explanation being that it was practically a loss, at least so far as getting a binder which would furnish a contact. Not having that, the air space in between acted as an insulator, and the coal ran hotter than it would without any cover on it at all.

Mr. Grafton:—Speaking from the tank block manufacturer's standpoint, I don't believe there is any doubt but what a water cooled tank will get more service from the tank blocks than those without. I know several factories, one in particular, where they have an air cooled system, that is a volume of air blowing on all the joints, and I know this prolonged the life of that tank. At the same time, a glass company at Evansville, Indiana, have a system of their own, consisting of a two-inch pipe surrounding the tank filled with water, over the throat and everywhere, to resist the heat. They have also prolonged the life of their tank. At the Johnson Glass Company of Hartford City, the conditions referred to by Mr. Yung were different. The blocks were entirely gone around the dog house and were entirely eaten out to a point eighteen inches below the surface. The glass was resting against the water coolers. I was talking to a manufacturer not long ago in regard to the repairs of his tank. He was holding up the repairs because he was considering the installation of water coolers,

but he finally gave the matter up, for the reason that the cost of furnishing water to these coolers, even though they prolonged the life of his tank for six or eight months, would cost him more than repairing his tanks with new blocks.

MR. BROWN:—If you go into water cooling, you can easily use up 300,000 gallons a night.

MR. CHAIRMAN:—Use it up or circulate it?

MR. BROWN:—That is up to you.

MR. FORSYTH:—We are experimenting a little bit with this, but only a trifle. The amount of water required, even on a small cooler, is a large item. The first thing you have to consider is the amount of scale deposited by your water. What would be the efficient temperature to run your water from the overflow to these cooling tanks? If you were running the water straight through the cooler to the sewer, naturally you would want to run that at as high a temperature as possible. But apparently there is no data on the amount of the settling on any particular water as you raise the temperature from the temperature of the main to the boiling point, and the only way would be to have some kind of a cooling system —tanks or otherwise—in which you eventually move all the salts that will precipitate out of your water. Then the only amount of water you have to add from your mains is that due to evaporation during your cooling. Unfortunately, in our plant we are not situated so that we can install this kind of a system and we have to run the water into the sewer. It certainly requires a large amount of water, especially when you are not sure how much of the temporary hardness will be precipitated out. To my notion, it seems our waste water will run out at a low temperature, which is better than taking the chances of heating up and depositing scale, even though the water jackets are equipped with a so-called "wash-out" system.

MR. BROWN:—There is a difference between hard and soft water. You had better get your water softer if you are going to use coolers.

MR. FORSYTH:—In using the water over and over again, you eliminate that.

MR. BROWN:—It then comes down to a question of water purification.

MR. WILLIAMS:—I would like to suggest that water cooling is probably a step in the wrong direction in solving our tank problems; not but that water cooling might be a temporary remedy for maintaining the life of a tank, but after all, the weakness is in the refractory. Further cooling is carrying off a lot of heat rather than saving it, and after all is said and done, what we are after is heat economy as well as tank life. It should be "insulation" and not a matter of "cooling by water" which should be the solution of tank life and heat economy at the same time. I mention that point so that in this discussion we won't lose sight of the fact that maybe

that is not the right way to do it after all, but the ultimate desirable way is "insulation" and heat economy.

THE CHAIRMAN:—I notice Mr. Wright has just come in. I am sure he can contribute something to water cooling of tank blocks.

MR. WRIGHT:—I think my experience has been possibly of a practical nature, something similar to those who used the water jackets for cooling tank blocks. I notice that the tank blocks wear away faster at the start than if they are air-cooled. From the time the block begins to get thin down to the point where it is one or two inches thick, the water jacket seems to be of help. I have heard of several places where water jackets have failed, but it was not necessarily due to the fact they were water jackets. The experience at a plant not very far from ours was that about three weeks after they started they lost a tank, and I think it was due to the fact they had dirty water; they allowed the water jackets to become filled with sediments, and the water jackets acted as insulators rather than a cooling medium.

MR. BELLAMY:—I haven't had any experience with water coolers, but what has been said has resolved itself into a case of transferring the cold from the water to the tank blocks, and in those cases, where it has worked, it has been a case where the circulating water has cooled the block and the other was where the contact between the cooler and the block has not permitted the transfer.

THE CHAIRMAN:—Mr. Williams mentioned the case of a steel furnace. The steel men evidently have analyzed their costs, and they have come to the conclusion, that even though they do burn up a furnace in a short time, they are ahead of the game. But in the glass industry we perhaps don't realize the relative cost of material and tank refractories. I think if detailed costs were set up for tank blocks and refractories, we would find the cost of repair is insignificant compared with tonnage we can get off. In other words, what I am trying to say is, there is a point where we can force our tanks harder with shorter life and finally be better off than if we nurse along the tank blocks.

A MEMBER:—Doesn't that statement hold good as applied to water coolers? If you put a water cooler on the side of the tank, the only service it seems to me is to keep the block cool, to keep it from wearing away; that means you are taking heat away from your furnace continually, and not only have the cost of pumping the water, but also have the cost of heating that water, which naturally comes on your coal bill. And it seems to me the increased cost of fuel consumption or increased cost of the coal which you would be using would, to a very large extent, offset any advantage you would get from your water cooler, and you might be better off to allow your blocks to burn out and replace them more frequently, than to have a vapor heat that way.

THE CHAIRMAN:—That is something along the line I had in mind. It is an investigation of your cost as distributed over tank repairs and fuel cost. Fuel cost is a big item. Mr. Brown has said it takes 300,000 gallons of water a day to cool something or other down in Charleroi. 300,000 gallons of water a day certainly runs into money. I think it is up to the tank block people to give us blocks that won't corrode. I think we are all agreed on that. Let us hope that this is just a temporary expedient, and we will get refractories that will stand up. I think Mr. Williams' point on that is exceedingly well taken. Of course, I am in the glass business and not the tank block business.

ACTIVITIES OF THE SOCIETY

A MESSAGE FROM PRESIDENT RIDDLE

Membership

Our Sporting Editor, in the October issue of the *Journal*,[1] announced the close of the Base Ball Season.

Past experience has shown that football is far more popular among our members than base ball. It is reasonable to suppose that the same condition will continue this year. So far the 1922 reports show an increase of 189 personal and 60 corporation members.

Our athletic board is very capable and Athletic Director Purdy is too well-known to require an introduction. Some of you have not met Manager Bowman but you will hear more of him before the year is over. The publicity department, under the direction of Miss Van Schoick, is doing all that can be asked. It is understood on good authority, however, that Coach Binns is in need of more raw material if she is to develop seven good division teams. A good many are fine on the defensive but what we really need are a lot of good tacklers. Miss Binns believes in open play; in fact, she states that the farther you are from Columbus the better, as long as you tackle, as you may get somebody going around the end, with whom no one else could get in contact.

Advertising

A study of the financial statement for September and a comparison of the receipts and estimated income as shown by the Budget prepared last February bring out several interesting points. Our Budget shows an estimated income for 1922 dues and subscriptions of $20,500 while the receipts for the first nine months are very close to $17,000. This, the accounts receivable and the revenue to be received from additional memberships, provided you do all Coach Binns expects of you, will bring the total receipts from these two sources well up to the estimated figure.

The receipts from advertising, however, have not shown the increase which was anticipated nor which a great many feel the increase in the circulation of the *Journal* warrants. We have a capable, experienced advertising manager but no matter how hard he may work he will not be able to continue to sell advertising without your support. Advertisers primarily judge a journal by its circulation, considering not only the number of people reached but also the character of those people and their ability to buy the particular commodity which is being marketed. This primary judgment will sell advertising in the beginning but it will not continue to sell it unless the merchant feels he is getting proper returns.

Comparison of the total volume of business done before and after undertaking an advertising campaign is one method of determining the value of the advertising; however, a good many merchants keep account, as far as possible, of the increase in sales due to advertising in each particular medium. Here is where you can be of great benefit to the Society.

1. Do you read the advertisements in our *Journal?*
2. When you write to an advertiser in the *Journal* do you tell him you read his advertisement in the *Journal?*
3. When you read an advertisement in another journal that ought to be in ours, what do you do?

[1] *Bull. Amer. Ceram. Soc.*, **1**, 254 (1922).

4. Do you realize that if you interest somebody in placing a full page advertisement in our *Journal* for a year you are helping as much as if you secured sixty new personal members?

5. Should you be advertising in the *Journal?*

Please think these points over. Get in touch with our Advertising Manager, LeRoy W. Allison, 170 Roseville Avenue, Newark, New Jersey.

PAGE THE CHEER LEADER!

The football squad of the American Ceramic Society has already made a record for itself. Two full teams are in the field and although nine or ten of the men are new material they are all making good.

Wainford was the big man of the team this month, as by several spectacular plays he gained forty yards in the second quarter and completed a forward pass to Bowman. Lemley also starred, making a twenty-yard gain around left end and completing a forward pass to Office. Parmelee, Rochow, Cox, J. B. Shaw, Lindemann, and Blumenthal made consistent plunges through the line for twenty yards each. H. S. Kirk on a trick play gained ten yards around right end and completed a forward pass to Rhead. O. O. Bowman 2nd was good for two forward passes. Substitutes were sent in at various times and showed much promise. Landrum, Rhead, W. J. Rees, G. H. Brown, Howat, Stern, Gaudette, Bales, Gilfillan, and Moulton were each good for ten yard gains, and Nickerson completed a forward pass to Office. The climax came, however, when in the last minute of play S. Momoki, the diminutive Japanese end, got the ball on a fumble and made a thrilling run for a touchdown. The referee unhesitatingly declared the game a victory for the October side, and nothing but the proximity of the ceramic department with its classes of earnest students pursuing solemn figures across mournful blackboards prevented the office force from doing a snake dance down the hall. The record of each man on the team follows:

	Personal	Corporation		Personal	Corporation
C. W. Parmelee	2		J. B. Shaw	2	
W. F. Rochow	2		W. C. Lindemann	2	
Paul E. Cox	2		H. S. Kirk	1	1
R. D. Landrum	1		Charles Gaudette	1	
R. H. Wainford	4	1	Geo. Blumenthal	2	
F. H. Rhead	1		C. E. Bales	1	
W. E. Lemley	2	1	J. M. Gilfillan	1	
W. J. Rees	1		D. A. Moulton	1	
G. H. Brown	1		O. O. Bowman, 2nd		2
W. L. Howat	1		F. P. Nickerson		1
Newton W. Stern	1		S. Momoki		3
			Office	2	3

Total: 31 Personal, 12 Corporation

The net increase for the first nine months of this year is:

	Personal	Corporation	Total
October 16, 1922	1567	211	1778
January 1, 1922	1350	139	1489
Net increase	217	72	289

The gross increase in membership by periods since June 1921 is:

	Personal	Corporation	Total
June to September 1921	41	11	52
September to December	18	2	20
December to February	136	21	157
February to May	81	10	91
May	13	13	26
June	13	5	18
July	25	11	36
August	20	5	25
September	31	11	42
October	31	12	43
	409	101	510
Loss	82	5	87
Net increase	327	96	423

NEW MEMBERS RECEIVED FROM SEPTEMBER 15 TO OCTOBER 15

ASSOCIATE

Archie, Charles L., Box 265, Corinth, Miss., Supt., Corinth Brick Co.

Armstrong, Robert E., 312 East 13th St., Indianapolis, Ind., Salesman, Harbison-Walker Refractories Co.

Atwell, Donald B., 4447 Washington Blvd., St. Louis, Mo., Evens & Howard Fire Brick Co.

Bisby, Grace Griswold, Pinos Altos, New Mexico, Supt., Grant County Schools.

Camp, Arthur D., Box 503, Williamsport, Pa., Supt., Williamsport Building Products Co.

Carter, J. Guild, Trenton Flint and Spar Co., Trenton, N. J., Sales Representative.

Chiang, Kuan-Tsen, 1305 Yale Station, New Haven, Conn., Student.

Coss, Harold T., Y. M. C. A., New Brunswick, N. J., Student, Rutgers College.

Cuffin, John, 208½ North 22nd Street, Portland, Oregon, Supt., Denny-Renton Clay and Coal Co.

Girling, William G., c/o Henry Foster & Co. Ltd., Backworth, Newcastle-on-Tyne, England, Director and Works Mgr.

Habas, Sol, 634 S. Warren St., Trenton, N. J., Student, Rutgers College.

Hanna, Ralph E., 149 Rector St., Perth Amboy, N. J., Chemist, Atlantic Terra Cotta Co.

Hoehn, Charles J. P., 2902 Nineteenth St., San Francisco, Cal., Pres., Enterprise Foundry Co.

Holley, Kenneth E., Alfred, N. Y., Student, New York State School of Ceramics.

Howes, George W., Dowagiac, Mich., Gen. Supt., Beckwith Co.

Johnson, A. G., 115 Hyland Ave., Ames, Iowa, Student, Iowa State College.

Kane, Evan O'Neill, Jr., Kushequa Brick Co., Kushequa, Pa., Asst. Mgr.

Ludlow, George M., 565 Washington Blvd., Chicago, Ill., Pres., Sanitary Scales Co.

McAfee, William K., 305 Highland Ave., New Castle, Pa., Engineer, Universal Sanitary Mfg. Co.

McCall, Gilbert, 685 Thurman St., Portland, Oregon, Foreman, Denny-Renton Clay and Coal Co.

Martin, George M., 894 E. State St., Trenton, N. J., Keystone Pottery Co.

Mason, T. Harry, 45 S. Hermitage Ave., Trenton, N. J., Supt., International Pottery Co.
Ockerman, Elmer H., Alfred, N. Y., Student, New York State School of Ceramics.
Schepers, Francis A. H., 1021 Emerald Ave., Chicago Heights, Ill., Chemist, Advance Terra Cotta Co.
Sheerar, Leonard F., Alfred, N. Y., Student, New York State School of Ceramics.
Smith, Leon B., Alfred, N. Y., Student, New York State School of Ceramics.
Snyder, Hiram T., Louisville Pottery Co., Louisville, Ky., Gen. Mgr.
Turner, William, 837 Plum St., Trenton, N. J., Trenton Potteries Co.
Wainford, Henry R., Jr., 2241 Chestnut Ave., Trenton, N. J., Asst. Supt., Trenton Flint and Spar Co.
Willson, B. W., 322 Seventh St., Ames, Iowa, Student, Iowa State College.
Wysor, D. C., 40 Rector St., New York City, Mgr., Missouri Field, General Chemical Co.

CORPORATION

Canadian General Electric Co., Toronto, Ont., Canada.
Denny-Renton Clay and Coal Co., Seattle, Wash.
The Electrical Refractories Co., East Clark St., East Palestine, Ohio.
Globe Brick Co., Box 765, East Liverpool, Ohio.
Hardinge Co., Inc., 120 Broadway, New York City.
Iron City Sanitary Mfg. Co., 1514 Oliver Bldg., Pittsburgh, Pa.
Nippon Gaishi Kwaisha, Higashimatch, Nagoya City, Japan.
Nippon Toki Kwaisha, Noritake, Nagoya City, Japan.
Toyo Toki Kwaisha, Shinozaki, Kokura City, Japan.
The W. S. Tyler Co., Cleveland, Ohio.
Universal Sanitary Mfg. Co., New Castle, Pa.
Wainford Darling Co., Trenton, N. J.

WHO'S WHERE IN THE AMERICAN CERAMIC SOCIETY?

Howard C. Arnold has notified the office of a change of address in St. Louis, Mo., from 4906 McPherson Avenue to 4020 McRee.

Erling E. Ayars, of the American Refractories Co., has been transferred from Devils Lake, Wis., to Joliet, Ill.

W. W. Coates, Jr., has moved from Lawrence, Kansas, to St. Joe, Mo., where he may be addressed at the Y. M. C. A.

Earl Curry, of Willoughby, Ohio, who graduated from the ceramic department of Ohio State University last June, has accepted a position with Gladding McBean & Co., at Lincoln, Cal.

R. P. Herrold, of Zanesville, Ohio, where he is with the Mosaic Tile Co., has moved from Brighton Blvd., to 325 Adair Ave.

Herford Hope recently sent in to the office his new address which is, Liverton, near Newton Abbott, Devon, England.

C. E. Jackson, of the Warwick China Co., Wheeling, W. Va., has just returned from a trip to Europe.

Thos. N. Kurtz has severed his connection with the Standard Refractories Co. and has moved to 524 Penn St., Hollidaysburg, Pa.

P. William Lee, of Denver, Colo., has moved from Race St. to 507 Downing St.

Donald M. McCann, formerly of Zanesville, Ohio, has taken a position with the Sterling Grinding Wheel Co., Tiffin, Ohio.

F. L. Steinhoff, Managing Editor of *Brick and Clay Record,* has changed his residence in Chicago from Kedzie Ave. to 1122 East 67th St.

W. J. Sutton, a graduate student and assistant in chemistry at the University of Pittsburgh, has moved from Bellefield Ave. to 328½ N. Craig St., Pittsburgh.

Boris Trifonoff, formerly with the American Encaustic Tiling Co. at Zanesville, may now be found at 1244 N. Elm St., Muncie, Ind.

SOME OF THE LOST ARE FOUND

The Secretary acknowledges with appreciation information received from members of the Society with regard to the lost addresses printed last month. Six names have been restored to the rolls. The remaining unknowns are here listed in the hope that further information will be forthcoming.

Baker, G. V., Penn Feldspar Co., Philadelphia, Pa.
Bickel, Earl A., Postville Clay Products Co., Postville, Iowa.
Bramlett, Mrs. J. T., Enid, Miss.
Brett, R. C., Southern Clay Mfg. Co., North Birmingham, Ala.
Callaghan, J. P., c/o Teaque Hotel, Montgomery, Ala.
Dolley, Charles S., Keramoid Mfg. Co., Fort Madison, Iowa.
Greenwood, John L., Lehigh Sewer Pipe and Tile Co., Lehigh, Iowa.
Groocock, Alice, 865 Bathurst St., Toronto, Ont.
Henshaw, S. B., Libbey-Owens Sheet Glass Co., Charleston, W. Va.
Kitamura, Y., Shofu Kogo Kafushiki Kaisha, Kyoto, Japan.
Knote, J. M., Mines Dept., Sault Ste. Marie, Ont.
Lodwick, J. A., American Arch Co., 17 East 42nd St., New York City.
Meissner, Max, Sprague Canning Machine Co., Hoopeston, Ill.
Miller, J. J., Mellon Institute, Pittsburgh, Pa.
Mitchell, Leon W., Rock Island Stove Co., Rock Island, Ill.
Morrow, Robert P., Harbison-Walker Refractories Co., 1513 Rockefeller Bldg., Cleveland, Ohio.
Pendrup, W., Coonley Mfg. Co., Cicero, Ill.
Pire, Mrs. Ward L., 1745 East 116th Place, Cleveland, Ohio.
Pulsifer, H. M., Geo. H. Holb & Co., Chicago, Ill.
Ragland, N. A., Alberhill Clay and Coal Co., Los Angeles, Cal.
Reid, W. H., 10 Stanley Place, Yonkers, N. Y.
Risch, Edward J., 4935 Roscoe St., Irving Park Sta., Chicago, Ill.
Smith, Harry W., Roessler & Hasslacher Chemical Co., Box 360, Cleveland, Ohio.
Stewart, John G., 530 Union Trust Bldg., Cincinnati, Ohio.
Tefft, T. D., Hamilton, Ont.
Vodick, William J., 1733 Lake Ave., Wilmette, Ill.
Walcott, A. J., Bausch & Lomb Optical Co., Rochester, N. Y.
Yamamoto, Tamesburo, Yamatame Glass Mfg. Co., Osaka, Japan.

TWENTY-FIFTH ANNUAL MEETING

Silver Jubilee

Plans are being made for an unusually important program at the annual meeting in Pittsburgh, February 12–16, 1923. Leading men in ceramics and allied industries will be invited to participate in the opening session; the charter members of the Society will be honored at the banquet; and each division will have four sessions for the presentation of papers and discussion.

Since the January number of the *Journal* is to be devoted to a review of the history of ceramics and of the Society for the twenty-five years past, the period of the annual meeting will be devoted to a consideration of present and future problems.

A strong local committee has been appointed under the chairmanship of A. F. Greaves-Walker. The personnel is as follows:

EXECUTIVE COMMITTEE

A. F. Greaves-Walker, *Chairman*
E. W. Tillotson, *Vice Chairman*
R. M. Howe
A. Silverman
J. W. Hepplewhite, *Secretary*

RAILROAD TRANSPORTATION

C. C. Phillips, *Chairman*
Robert F. Ferguson
J. E. Hansen

HOTEL ACCOMMODATIONS

A. H. Chandler, *Chairman*
A. E. Blake
J. L. Crawford

PUBLICITY

Arthur W. Kimes, *Chairman*
John M. Hammer
E. W. Tillotson

SERVICE

H. G. Schurecht, *Chairman*
H. G. Elledge
Arthur E. Gray
Willard J. Sutton
W. F. Wenning

SMOKERETTE

Raymond M. Howe, *Chairman*
F. G. Lord
H. S. Robertson
Drew M. Thorpe

BANQUET

Alexander Silverman, *Chairman*
M. G. Babcock
H. L. Dixon
F. W. Donahoe
C. R. Peregrine
Francis W. Walker, Jr.

RECEPTION

J. Spotts McDowell, *Chairman*
Chas. R. Fettke
Francis C. Flint
H. C. Fry
Samuel M. Kier
Chas. J. Kirk
Donald W. Ross
H. G. Willets
E. J. Winkleman

FINANCE

Henry L. Dixon, *Chairman*
Marion G. Bryce
Porter Kier
J. M. Lambie
Kenneth Seaver
Thos. Wilson

ENTERTAINMENT OF LADIES

Mrs. A. F. Greaves-Walker, *Chairman*
Miss Edna P. Carson
Miss Mabel C. Farren
Mrs. H. L. Dixon
Mrs. R. M. Howe
Mrs. Alexander Silverman
Mrs. E. W. Tillotson

TRIPS

J. Spotts McDowell, *Chairman*
D. M. Buck
J. W. Cruikshank
L. P. Forman
Marsden H. Hunt
F. K. Pence
Francis W. Walker, Sr.

A Letter from the Pittsburgh Chairman

Pittsburgh, Pa., October 17, 1922

To the Members of the American Ceramic Society:

The next annual meeting of the Society will be held in Pittsburgh, Pennsylvania, February 12 to 16. This will be the twenty-fifth anniversary of the birth of the Society and we are, therefore, referring to it as the Silver Jubilee Convention. Pittsburgh was selected for the celebration of this occasion because it was in this city that the original plans for the Society were laid twenty-five years ago.

The Local Committee, in conjunction with the officers of the Society, are planning to make this the biggest and most enthusiastic meeting the Society has ever held, and it is hoped that every member of the Society will accept this as a most cordial invitation to be present. It is confidently expected that from seven hundred to eight hundred members will attend.

The Local Committee has already laid its plans. The general meeting will be held at the William Penn Hotel, which will also be headquarters for the Society, on the 12th, as will also the Banquet on the evening of that day. On the evening of the 14th the Smokerette, which will this year include dancing, will be held at the William Penn. The Fort Pitt Hotel will be used for Divisional Meetings, of which this year there will be four instead of three as in previous years. The evening of the 13th has been purposely left open by the Committee with the idea that it could be used for little social gatherings and for Alumni dinners and meetings.

It is planned by the officers of the Society to invite for this Silver Jubilee Convention a number of the most prominent scientific and technical men in the country and it is expected that several of these will be heard at the Banquet. It is expected that there will also be a full attendance of the charter members now living, which will add greatly to the occasion.

Plans have been made to entertain the largest attendance of ladies and it is sincerely hoped that every member who can will make it a point to bring his wife with him.

On account of the large attendance expected it is not too early to make hotel reservations. This can be done by addressing either the William Penn or Fort Pitt Hotels, or the Chairman of the Local Hotel Accommodations Committee.

Sincerely yours,
(Signed) A. F. GREAVES-WALKER, *Chairman,*
Executive Committee, 25th Anniversary Meeting

REPORT OF COMMITTEE ON RULES

Amendments to the Constitution

Herewith are amendments covering two classes of memberships (*a*) *Ex Officio* Honorary, (*b*) Perpetual. These were proposed in August 1921, were considered and finally approved by Committee on Rules and Committee on Membership acting jointly. They were not presented to the Society at the St. Louis Convention so as to give the 1922 Rules Committee opportunity to review them. They were finally presented at the September 15, 1922 meeting of the Society in New York City.

Ex Officio Honorary Members: This Society has at times honored officers of the ceramic societies of other countries by electing them to honorary membership during the term of their official incumbency. No distinction has heretofore been made between our "life" Honorary and these "temporary" Honorary memberships.

Perpetual Active Memberships: The conception behind provisions here proposed cover the "life" membership and the "permanent endowment" ideas with which our parliamentarians have for long been working. The amendments here proposed give opportunity to pay an endowment fee, the interest earnings of which will cover all regu-

lar dues during the life of the member as in the customary "Life Memberships;" and at the death of the member the fee will be transferred to a permanent research endowment fund, and the name of the member forever kept on the roster of the Society appropriately designated as having so contributed to the support of the work of the Society.

Proposed Amendments to Constitution and By Laws

Article II

#1 The Society shall consist of Honorary, *Ex Officio* Honorary, Active, Perpetual Active, Associate, Corporation and Industrial Association and Perpetual Corporation Members.

#4 *Ex Officio* Honorary Members must be such officers of such other associations and societies as shall be unanimously designated by the Board of Trustees, the name of the person holding such office appearing on the Society roster as *Ex Officio* Honorary Members during the term of his incumbency only.

#5 Same as present #4.

#6 Same as present #5.

#7 Perpetual Active Members must be those members, active or associate, who make single payment of an endowment fee as prescribed in Article III. Their names shall appear on the Society roster perpetually. Perpetual Active Members shall have the same rights as Active Members.

#8 Same as present #6.

#9 Same as present #7.

#10 Perpetual Corporation Members must be persons, firms, or corporations who make single payment of an endowment fee as prescribed in Article III. Their names shall appear on the Society roster perpetually. Perpetual Corporation Members shall have the same rights as Corporation Members.

#11 Same as present #8.

#12 All Honorary Members, *Ex Officio* Honorary Members, Active Members, Perpetual Active Members, Associate Members, Corporation Members, Perpetual Corporation Members and Industrial Association Members shall be equally entitled to the privileges of membership, except that only Active, Perpetual Active, one representative of each Corporation Member, and one representative of each Perpetual Corporation Member shall be entitled to vote. Such representative shall be officially designated by the person, firm or corporation represented. Only Active and Perpetual Active Members shall be entitled to hold office. The roster of each grade of membership shall be printed separately in at least one publication issued by the Society annually.

#13 Any person may be expelled from any grade of the membership of the Society if charges signed by five or more Active or Perpetual Active Members be filed against him or her, and if the Board of Trustees examine into and sustain said charges by a majority vote. Such person, however, shall be notified of the charges against him and be given a reasonable time to appear before the Board of Trustees or to present a written defense before final action is taken. In case of such expulsion, any moneys paid the Society as endowment fees become forfeit to the Society and automatically become part of the research fund.

Article III

#1 Honorary and *Ex Officio* Honorary Members shall be exempt from all fees and dues.

#3 Perpetual Active Members shall pay a single endowment fee of $200.00,

the interest earnings from which shall be used during the life of the member for current expenses. Upon the death of the member, the interest shall be used according to the direction of the Board of Trustees for ceramic research. The privileges of membership shall begin upon payment of this fee.

#4 Same as present #3.

#5 Perpetual Corporation Members shall pay a single endowment fee of $600.00, the interest earnings from which shall be used for current expenses for a period of twenty-five years after which time the interest shall be used according to the direction of the Board of Trustees for ceramic research. The privileges of membership shall begin upon payment of this fee.

#6 Same as present #4.

T. A. KLEINFELTER,
Chairman, Committee on Rules

AMENDMENTS PROPOSED BY TEN MEMBERS

Article XII of the Constitution makes provision for any ten members presenting proposed amendments the same to be read at a regularly called meeting of the Society and voted upon by letter ballot by the Active Members. The following two amendments were thus presented by Mr. Homer F. Staley and nine others:

(1) **Elimination of "Associate" Members.**

Article II.—Membership

(1) The Society shall consist of Honorary, Active, Corporation and Industrial Association Members. All members of the former "Associate" grade are hereby made Active Members.

(4) Eliminate.

(5) Eliminate.

(6) Active Members must be persons interested in the ceramic or allied industries.

(9) Eliminate "Associate Members."

Article III.—Dues

(2) Eliminate "and Associate."

By-Laws

Section IV. Eliminate "and Associate."

Section VII. (3) Change "Associate" to "Active."

(2) **Change in Board of Trustees and Method of Electing the Board Members.**

Article IV.—Officers

(1) The affairs of the Society shall be managed by a Board of Trustees consisting of the President, the Vice-President and as many Trustees as there are Divisions of the Society. The President and Vice-President shall be elected as prescribed in Article V to serve one year. One Trustee shall be elected annually by ballot by each Division at the last session of the Division held during the annual meeting of the Society. A Trustee may be reëlected to serve not more than three consecutive years.

(9) A Treasurer shall be appointed by the Board of Trustees for a term of not more than two years. (Then continue as formerly.)

Article V

Eliminate "Treasurer and one Trustee." Put "and" between "President" and "Vice-President."

SHALL I JOIN THE SOCIETY NOW?

At this time of year new members are sometimes dismayed at the information that payment of dues now does not preclude the receipt of a bill for 1923 dues on January first, since all memberships are considered as extending from January to January, and payment of dues at any time of the year entitles a member to all the *Journals* for that year.

The reasons for this practice are two. Most members wish to have the *Journal* in complete volumes, and the Society finds it advantageous to keep the stock of the different numbers as uniform as possible.

"But," we hear someone say, "I don't want to receive nine or ten *Journals*, back numbers, all at once."

The answer to this is found in the casual remark of a Columbus man who joined the Society in September. He came into the office one morning and said, "Well, nine *Journals* arrived in my mail this morning and I have glanced at the tables of contents. I see thirty articles of direct interest to me and many more of indirect interest."

We thanked him and jotted this down on our solid ivory tablets for use in the Bulletin.

We believe that a man who joins the Society in September, or even December, and pays a year's dues, gets his money's worth before he receives a bill for the new year's dues in January. The Annual Meeting, with each of the seven divisions carrying a crowded program, provides papers for the entire year, so that most of the material appearing in the last issues of any year are no older, so far as investigation and experiment are concerned, than those which are used in the earlier numbers. Then too, discussions printed in November, for example, may refer to original papers printed in May; while the index in the December number would be of little importance to a member if the last two or three numbers only were in his possession.

New applicants are given a chance to elect whether they will join as of the old year or as of the coming year, when they are accepted for membership during the last three months. But we feel that, did they understand what they would receive or what they would miss, according to their decision, there would be little hesitation about paying dues at once, regardless of the fact that another bill would be forthcoming in January. Furthermore, three months' grace is given for the payment of the January bill.

REPORT OF COMMITTEE ON NOMINATIONS

Officers for 1923 and Trustee to Serve Three Years

For President, A. F. Greaves-Walker
For Vice-President, Robert D. Landrum
For Treasurer, Ralph K. Hursh
For Trustee, Ralph R. Danielson

ABSTRACTLY SPEAKING

It is a matter of pride in the editorial office and, we hope, satisfaction to the members of the Society, that the number of Abstracts from our own staff is increasing. This month, out of 164 abstracts, 116 are from our own abstractors. It has been our aim to have the ratio of our own Abstracts to those from *Chemical Abstracts* at least 2 to 1, and not 1 to 2 as it had to be before we were "abstractedly self-supporting." J. L. Crawford, J. W. Hepplewhite, R. M. Howe, H. P. Hood and R. R. Danielson have been added to the list of abstractors.

NORTHERN OHIO SECTION

The sixteenth regular meeting of the Northern Ohio Section was held on October 10, at Hotel Winton, Cleveland. Lunch was served at 1 P. M. after which the technical program was taken up.

Mr. B. A. Rice, ceramic chemist with the Elyria Enameled Products Company, introduced a discussion of the determination of the physical properties of enamels, such as the coefficient of expansion, adhesion, and the elasticity. These three are the properties which would seem to be connected with the tendency to fishscale. An interesting account was given of experiments made on enameled ware, and of attempts to form the enamel into a rod or bar by pouring into heated molds, also suction. The problem of forming a specimen of accurate, uniform dimensions seems to be the greatest stumbling block.

Mr. J. H. Forsyth, Glass Technology Department of the National Lamp Works, gave a lively account of the main features of the Society's Canadian trip.

A visit was made by some of the members to the Research Laboratory of the National Malleable Castings Company, where the unusual facilities for high temperaure work and mechanical testing proved of great interest.

A. F. GORTON, *Secretary*

NEW ENGLAND SECTION

At a special meeting of the Executive Committee of the New England Section, O. S. Buckner was appointed Chairman and C. W. Saxe, Secretary, for the balance of the year 1922. Both Mr. Buckner and Mr. Saxe are with the Norton Company, Worcester, Mass. Plans are being made for a meeting of the Section at Worcester on October 28.

NOTES AND NEWS

THE PROBLEM OF PLASTICITY TO BE STUDIED

THE RESEARCH COMMITTEE, WM. H. CLARK, CHAIRMAN, MAKES THE FOLLOWING ANNOUNCEMENT

Of prime importance to ceramists is the proposed research to be pursued at Lafayette College, Easton, Pa., under Professor Eugene C. Bingham, on the fundamental problems of plasticity, provided funds to finance the work are forthcoming.

Those who have seen his invaluable book "Fluidity and Plasticity,"[1] recently published, will not question Professor Bingham's authority and power to handle this subject.

The Research Committee of the American Ceramic Society endorses the proposed plan of research and urges individuals and firms to contribute to the fund for the purpose.

The General Electric Company has subscribed $1,000 with this comment:

"We had your book of the Talbot Series, and it seemed to us that, if any type of research outside of our strict local laboratory undertakings should receive financial assistance from this Company, it is that which you are carrying on."

Subscribers may send their contributions to R. C. Purdy, General Secretary, American Ceramic Society, Lord Hall, Ohio State University, Columbus, Ohio, with the assurance that such will be promptly forwarded.

Professor Bingham's clear statement of the needs and purposes of his plan follows:

Dear Sirs:—

For several years research work on the subject of plasticity has been carried on at Lafayette College, in the Gayley Laboratory. The results are now generally available in

[1] See review, *Ceram. Abs.*, **1**, 172(1922).

a book published by McGraw-Hill Book Co., entitled "Fluidity and Plasticity." Enough has been done to show that paint, rubber, nitrocellulose, starch, metals and their alloys, road-building materials, and many other colloids are plastic materials and not viscous liquids as heretofore assumed. This changes our conceptions, for we are really dealing with two properties, yield value and mobility, instead of the one property, viscosity. The relationships are apparently governed by simple laws, but our knowledge of the whole subject is very fragmentary.

We have an Edward Hart Fellow and a du Pont Fellow engaged in working out these problems, but the work is painfully slow and with a full schedule of teaching I have little time myself either for research or for directing the research of others. Lafayette College, through President John H. MacCracken, has agreed to give me practically my entire time for research, provided that $3,600 a year can be secured for the employment of another man to carry the elementary teaching, which is now a part of my work. The college will of course furnish the laboratory space, equipment, etc.

Several firms have shown interest in the work on plasticity and have offered to coöperate in a variety of ways, which prompts me to write this letter. From the nature of the work in which you are engaged, I believe that you are interested from a practical point of view in seeing our knowledge in this new field greatly amplified, just as the writer is from a scientific point of view.

My own interest in this work is such that I agree to give $1,200, which is one-third of the whole amount required, out of my own salary, and I only regret that I cannot do more. Perhaps, however, even this will indicate good faith.

In case we can raise $3,600 for the year 1922–23 the entire time of one man will be devoted to research and its direction.

It is proposed to make a study of the fundamental problems of viscous and plastic flow, and it is hoped that the results may be applicable to all colloid problems and not limited to problems of flow in a single industry. The results of the research will be made available through publication.

Will you or your firm share in establishing this fund for research in plasticity for the year 1922–23?

Respectfully yours,

(Signed) Eugene C. Bingham

Chairman of Lafayette College Research Committee

COÖPERATIVE RESEARCH[1]

The Advisory Council in their Seventh Annual Report to the Privy Council for Scientific and Industrial Research tells of the research organizations and of the work being accomplished in England. We wish it were possible for every member of the Society to have a copy of this report because of the inspiration for coöperative research with which it teems. We quote here only a few paragraphs covering the objects and methods under their system of coördinated government and industrial supported research.

"The problem before the country, as we see it, is to provide a means which will enable its population of nearly 50,000,000 to live and prosper. It is well recognized that for four-fifths of their food and for a great part of the necessary raw and semi-manufactured materials for industry, the people of these islands are dependent on supplies from overseas. These supplies can only be obtained if this country is able to carry on its exporting industries in future with greater efficiency than the rest of the world, for it is doubtful whether we can compete, either by lowering wages beyond the limits of our competitors, or by securing a much greater human effort than they. If these two avenues are closed, competition, in the end, is confined to greater efficiency resulting from scientific work, for, in the long run, our outstanding business skill and organisation could not make good a deficiency of production or an obvious inferiority in our goods. We consider that scientific and industrial research, along the lines which

[1] Extracts from Report of the Committee of the Privy Council for Scientific and Industrial Research for the Year 1921–22, England.

we have laid down and on which we have been building during the past seven years, is an essential factor in the national effort on which the continued maintenance of our present population unquestionably depends."

"The utmost use must be made of the natural resources we possess, and at each stage through which our raw materials pass in their evolution from the natural state to the most highly finished product, the utmost efficiency of the machinery employed and the human skill applied must be secured if we are to succeed. The fullest utilisation of the discoveries and methods of science, through close association with industrial effort, alone can ensure the achievement of this end."

Research Associations

"Twenty-four research associations have received licenses from the Board of Trade and twenty-two of these are in active operation. In addition, three other industries have the possibility of forming such organisations under immediate consideration and research associations are likely to be launched in these cases in the near future. Preliminary negotiations are taking place with several other industries.

"Of the twenty-two associations referred to above, two have at the date of this report just passed into their fifth year of grant aid and four others have commenced their fourth year; nine associations are in their third year and seven are in their second year.

"When the Government scheme for industrial research was started it was thought that a period of five years would give reasonable time for an industry to test and try the value of coöperative research; for this reason the offer of grant assistance was made for a quinquennium in each case. The scheme cannot be described as an experiment in the value of research as applied to industry, for long before the scheme was instituted a number of firms possessed successful research laboratories; no experiment was needed to prove to these the value of scientific research. But privately organized and financed laboratories were only for the wealthy corporations; the smaller firm could not hope to face the outlay and the annual charges involved, however much it might be convinced of the utility.

"There are many indications that the industrial world is tending to move from an age of pure competition between firm and firm to one in which the element of competition will be merged in emulative coöperation. The scheme is in general consonance with this tendency, though the success of the movement as a whole may only be partial, and actual failure may occur in individual instances, for the economic conditions which have prevailed during recent years have been exceptional and have put obstacles of a most formidable type in the way. For this reason the five-year period has been a less effective test of the ultimate usefulness of coöperative research than it would have been under more normal conditions. In any case, five years is no lavish space in which to set on foot an institution, to equip it with men and material appropriate for its purpose, and to produce results sufficient in value to prove the worth of the undertaking.

"Experience has shown that the best part of two years is required before the organisation can be said to have got into its stride and to be in a position to attack its problems. If in the following three years some results of value emerge, then there will be justification for the State's educational endeavor and for the faith of the pioneers in the various industries to whom the movement owes so much. That results of value will come sooner or later we have no shadow of doubt, but we trust that, if in certain instances they do not come sooner, the particular industry and its upholders will not give up hope. When times are bad and every item of expenditure has to be narrowly scanned, the subscription to a research association which has not yet produced tangible results may seem to be an addition to the budget of dubious value, even though it

may be no more than a workman's or foreman's wage for the year. The cost of supporting research cannot indeed be justified by comparing it with the prime cost of production—especially when demands are falling off—but by the consideration that it is the means of improving and cheapening production and, in consequence, of increasing the demand. Research, as we have often pointed out, is a cost in the same category as insurance. It is an insurance against the effects of ignorance with the certainty, if it is wisely undertaken, of large and continuous bonuses."

Coöperation

"We have said that the Government scheme of aid to industrial research is an educational venture. It is experimental in the sense that it is an attempt to establish coöperative research in this country, and the experiment has been opportune. At the very moment when private industrial research organisations have found it necessary to diminish their expenditure and, consequently, to curtail their activities, established research associations, with a guaranteed income during their first five years of existence, have been given the certainty of being able to arrange their programmes without fear of drastic economies during that period. No coördinated scheme of work can be devised and followed unless an assured and sufficient income is available for its prosecution. A staff, however devoted, cannot be expected to give single-minded attention to their work if they are anxious as to their future for reasons in no way connected with their efficiency.

"Coöperation is the essence of the scheme and every year shows fresh directions in which team work in the widest sense can serve a useful purpose. Firms of varying size and financial strength can pool their resources according to their standing and can enjoy the results which that partnership secures. To the smaller firms this is of particular value for, otherwise, research work and the expense it involves would not be within their powers. Team work within an association is also of the first importance. A research worker thrown among a number of his fellows with whom he can confer, compare notes, and consult, has more chance of producing results than he would have in the isolation, or in the comparative isolation, of a smaller organisation, especially when he has the advantage of serving under a chief with wide vision and experience.

"During the past year, fresh evidence of the value of coöperation has been forthcoming in other directions. In several instances, two or more research associations have found it profitable to join forces in attacking some common problem, realising that each can supply something of use to the other to their mutual advantage. Thus the British Cast Iron Research Association and the British Refractories Research Association are joining forces in investigating sands and refractories. The Research Association of British Motor and Allied Manufacturers and the British Cast Iron Research Association are jointly dealing with the casting of cylinders, while the important subject of die-castings is being approached by the Research Association of British Motor and Allied Manufacturers, the British Non-Ferrous Metals Research Association, the British Scientific Instrument Research Association and the British Electrical and Allied Industries Research Association, in collaboration. Again, the Glass Research Association and the British Refractories Research Association have joined in an investigation into the refractories used in the glass industry. Further coöperation between research associations and various Government departments has been found possible and mutually beneficial.

"Thus it is that the scheme, which was designed primarily with the object of co-operative endeavour on the part of individual firms in the same industry, is becoming the means of bringing still larger interests together for a common purpose. This principle is likely to prove a prominent factor in organised industrial research of the future. The raw material in one industry is the finished product in another; it must be to their

common advantage for the makers of the two to come together. We have discussed elsewhere the conditions under which it is possible to combine producers and users in a single research association and these necessary conditions are not often found to be present. But although the producer is better able to conduct researches for the development of more economic processes or improved products than is the user, he often needs the necessary stimulus. The Gas Companies desire gas stoves to be more economical because they realize that while the consumption of their product would be less per stove, the number of users would be vastly increased. But, because the consumers were unorganised, it took the Gas Companies a long time to discover this simple truth. Research associations bring about an organised criticism of the product used in their industry and thus lead the way to improved production by the manufacturers of the materials they use. Coöperation between a research association of producers and a similar association of users thus becomes simple and natural within the limits of their common interests. Many examples of this tendency could be cited and the principle was clearly before the eyes of the Government in founding the scheme, for it expressly provided means for coöperation between different research associations in attacking specific problems."

Headquarters of Research Associations

"Some research associations have their own laboratories, some rent suitable accommodation from universities or other public institutions, and some delegate the whole of their work to experts engaged in universities or elsewhere. There is evidence that, wherever possible, it is advantageous to an association to have its own research station. The advantage lies not only in the concentration of a staff and their research work under the eye of the Director, but in the fact that the existence of the research station stimulates the interest of the members of the association. If a member can enter a research institute created by the association of which he is a supporter, he feels a sense of ownership and a keener interest in its work. This interest is essential to the permanent success of the undertaking. Moreover, when Government grants cease at the end of the quinquennial period, the existence of a fully equipped research establishment will be a further incentive to the members to see that its continued maintenance is not jeopardized by lack of funds. The good will of a research association will be larger in the case of an association in possession of its own headquarters than in the case of one which has conducted purely extra-mural operations.

"Research associations have proceeded in the matter of headquarters along different lines. The British Cotton Industry Research Association has an annual income at present of about 20,000 pounds a year; in addition it received a large grant from the Trustees of the Cotton Trade War Memorial Fund. With funds of this order behind it, and with over 90 per cent of the firms in the whole industry members of the Association, the Council was in a position to acquire and equip premises on a large scale. The Shirley Institute, as the headquarters of the Association is called, consists of a large mansion standing in $14^1/_2$ acres of freehold land. The house has been fitted up to provide accommodation for a library and information bureau, a council chamber, refractory and administrative offices and residential accommodation for certain members of the staff. In the grounds have been erected up-to-date and well-equipped laboratories on the most modern principles; in addition, there is a series of workshops for the construction and repair of instruments used in the laboratories and for the general maintenance of the Institute. In another part of the ground eleven houses have been erected for the use of married members of the staff.

"The British Cotton Industry Research Association has been honoured by a visit from H. R. H. the Duke of York, K. G., who declared the Shirley Institute open on March 28, 1922. We realize that by this gracious act His Royal Highness has conferred the

benefit of Public recognition not only on the British Cotton Industry Research Association but on the movement for industrial research as a whole.

"Less wealthy associations have had perforce to content themselves with less ambitious homes but several have acquired properties which have been adapted to provide commodious and convenient laboratories. The Linen Industry Research Association has acquired a large house standing in 22 acres of ground which is almost as impressive as the Shirley Institute, the laboratories in this case being provided in the house itself. The British Research Association for the Woolen and Worsted Industries and the British Portland Cement Research Association also own substantial establishments.

"In several cases, for example, the British Scientific Instrument Research Association, the Glass Research Association, the Research Association of British Rubber and Tire Manufacturers, the British Association of Research for Cocoa, Chocolate, Sugar, Confectionery, and Jam Trades, private residences in London or the suburbs have been acquired and adapted with excellent results. A private residence of the proper size can be converted at a relatively low cost into a convenient and efficient research establishment. Private houses, with large basements but of substantial size and structure, can now be acquired at reasonable prices owing to the disfavour into which residences of this type have fallen. But the inconveniences which they present for domestic use are no serious drawback from an association's point of view. The despised basement lends itself, as a rule to the installation of apparatus requiring solid foundations,the capacious living rooms, with their large window space, are admirably adapted for laboratories, and where the house stands in grounds of its own, facilities can be provided for physical recreation. There is much to be said for making the conditions under which research is carried out as congenial as possible.

"The associations with small incomes at their command cannot aspire to separate headquarters and, in such cases, accommodation has been sought at university or other public institutions, where equipped laboratories are leased at a rent which includes the provision of gas, electricity and water. With a modest income this course is far wiser than more ambitious projects which may result in "Overbuilding." The cost of upkeep of the headquarters is a first charge on the resources of the association and, as time goes on, it does not diminish: as a result, the essential research work may suffer. There is a natural temptation to acquire what appears at first sight to be a bargain in the estate market, but a home which entails an undue amount of expense in the future is no more a bargain to a corporate body than it is to the private individual."

Nature of Research Undertaken by Associations

"In previous reports we have directed attention to the nature of the work undertaken by associations and have laid some stress on the importance of fundamental research as compared with work directed to the removal of immediate and practical difficulties. We hold the view that it is no part of the function of an association to undertake work which normally falls to the consulting chemist or physicist, or to the consultant called in to advise on difficulties in connection with a works 'lay out.' On the other hand, an association, especially in its early years when the confidence and support of the industry are being enlisted, may well feel disposed to allow its staff to undertake subsidiary investigations requiring great experience and knowledge for their completion, although they are not of the widest application. The staffs of several associations have successfully coped with difficulties of this kind and as a result have gained immediately the confidence and trust of their members. But these efforts have rightly been regarded as a secondary function and have not been conducted to the exclusion of the larger issues. These can only be solved by getting down to fundamentals.

"There is indeed little basic difference between the fundamental research work required by industry and academic scientific research sometimes styled 'pure' research.

The real difference is one of stimulus. The general tendency in 'pure' research is to follow the train of thought of greatest scientific interest by pursuing the problem initially selected through all the ramifications which may present themselves, or at least through all those which interest the investigator. The phenomena investigated and the taste of the research worker are, in most cases, the only directive forces. In industrial research, on the other hand, the aim is more definitely objective; the work has a distinct purpose in view which the investigator must bear in mind constantly. He cannot afford to follow attractive by-paths unless he believes they will lead him to a relevant destination.

"The problems of industry draw attention to gaps in scientific knowledge which it is essentially the duty of the industrial researcher to fill. The acquisition of such knowledge may be called fundamental research as applied to industry for, without it, far-reaching changes and improvements in industry are almost impossible. Thus it is that the British Cotton Industry Research Association finds it necessary to study the properties of single cotton fibres and the chemical constitution of the cellulose molecule. The British Photographic Research Association is occupied in investigating the fundamental properties of silver haloids and the physico-chemical properties of gelatin and similar colloids. The British Portland Cement Research Association is endeavoring to ascertain the exact chemical nature of the compounds constituting Portland Cement. It was only by an elaborate investigation of the primary phenomena of abrasion and polishing that the British Scientific Instrument Research Association was able to perfect the abrasives and polishing powders which are now proving of such industrial importance. In all such cases the research worker has ever before his mind the necessity of bringing his investigation to a practical issue.

"We have been led to make observations because we have found some evidence recently of a good deal of misconception in the distinction popularly drawn between 'industrial' and 'pure' research. There is undoubtedly some ground for this attitude in the loose use by industrialists and company promoters of the word 'research' to describe experiment by trial and error and in the attempts often made to solve complex industrial problems on the full scale without any adequate preparation for the passage from the laboratory to works production. The wise manufacturer knows better than this and the man of science supports him. But we maintain that the distinction between fundamental industrial research and 'pure' research lies primarily in the source from which the impulse to its conduct is derived. We desire rather to emphasise the essential unity of all genuine research; its stimulus may come from different sources; its applications may be various; but its outlook, its spirit, its methods are one."

DR. S. W. STRATTON RESIGNS FROM DIRECTORSHIP

Becomes President of Massachusetts Institute of Technology

With the resignation of Dr. Stratton as director of the Bureau of Standards, the American Ceramic Society undoubtedly loses its best and most influential friend in the scientific departments of the government. As head of the only government Bureau which has had a regular appropriation for ceramic investigations over a period of years, he has shown such an insight into and appreciation of the needs of the ceramic industry that all who have gone to him personally with problems have come away feeling that he understood the question and would keep in direct contact with it.

The Bureau of Standards secured its first fund for ceramic investigation in 1910, when the Technologic Branch of the Geological Survey was merged into it. The amount appropriated was a mere pittance—it would not now pay the annual gas bill which the

Bureau incurs in its investigations. Dr. Stratton, by his insistent efforts with Congress, has been able to impress it with the urgent need of more funds, so that by the end of the war the amounts available for the work at the Bureau amounted to about $70,000 annually. By his continued efforts since then, he has prevailed upon Congress not to curtail this fund, even though it was very materially reducing appropriations to all Bureaus annually. Dr. Stratton knew from personal contact that now especially was the need for more funds, even more so than at any other time in the history of the industry, if the lead held in so many lines during the war were to be maintained.

S. W. Stratton

During the past four years he was able to obtain practically a new plant for the Ceramic Division. The old cramped, totally inadequate quarters in Pittsburgh were abandoned and several suites of rooms on three floors in a new structure were especially designed and equipped with the most up to date equipment. In the new quarters at Washington the space devoted to kilns and furnaces alone exceeds the entire space available at Pittsburgh before the war. With the removal of the plant to Washington the employees felt the enthusiasm and interest of Dr. Stratton in their work more than ever, as evidenced to them through his almost daily visits to the laboratory when not out of the city. This he did although the Ceramic Division was but one of eleven divisions and occupied part of one of seven large buildings, for all of which Dr. Stratton has secured appropriations from Congress.

The best wishes of his many friends in the American Ceramic Society go with him to his new duties as President of the Massachusetts Institute of Technology. We believe he will carry on his interest in the ceramic industry, for his close contacts cannot be broken off abruptly. What event could betoken more for the development of the technical side of the ceramic industry than to hear that a well-designed course in ceramic engineering would be inaugurated at that institution as a result of his connection there? In any case those who may take their ceramic problems to the newly established Research department of M.I.T. in the future will know that its president realizes the importance of the problem and will be exerting himself anew in a field in which he is already well acquainted.

U. S. BUREAU OF STANDARDS PURSUES ENAMEL INVESTIGATION

Some preliminary tests have been conducted by the Bureau of Standards in a study of the causes of specking of ground coat enamels. This specking appears as spots of oxide and slag in the enamel coating, a condition which appears to be due to excessive local rusting of the steel previous to the firing of the enamel.

Preliminary tests have been made on steel cups furnished by a manufacturer of such articles and coated with regular stock enamels. The results of the test indicate that the rusting and subsequent specking are due to an excess of acid or salts in the enamel. The defect has been remedied by the addition of sufficient sodium hydroxide

to the enamel previous to the dipping operation. Since this defect is a serious one in the production of white enamel ware, it will probably be advisable to continue this investigation in order to go into the subject more thoroughly.

G. A. BOLE IS MADE SUPERINTENDENT OF CERAMIC EXPERIMENT STATION

Mr. G. A. Bole has been appointed Superintendent of the Ceramic Experiment Station, U. S. Bureau of Mines, at Columbus, Ohio, to succeed Mr. R. T. Stull who was advanced to the position of Supervising Ceramist last April.

Mr. Bole has efficiently served as Acting Superintendent for six months prior to his appointment as Superintendent. He came to the Bureau in August 1921 from the New York State School of Ceramics, at Alfred, New York, where he was for nine years head of the department of chemistry. Under his supervision were developed strong courses in physical chemistry as applied to ceramics, as well as courses in industrial fuels which included heat balances on power plants and ceramic kilns.

His work since coming to the Bureau has consisted principally of control work in connection with the industrial kiln investigation. Together with Mr. F. G. Jackson, he has been studying the oxidation of ceramic ware during firing.

The Bureau is at present carrying on industrial coöperative work with more than a dozen industrial concerns, as well as maintaining an efficient laboratory staff and laboratory car.

G. A. Bole

Mr. Ellsworth Ogden has been appointed ceramic engineer with the U. S. Bureau of Mines. Mr. Ogden's work will consist largely of field work. He comes to the Bureau with a wealth of ceramic engineering experience. Mr. Ogden's appointment was made upon the recommendation of Colonel Orton, Mr. Bleininger, and Mr. Purdy.

REPORTS OF INVESTIGATIONS BUREAU OF MINES

Production of Alumina from Clay Tests on the Miguet Process

By Clyde E. Williams (Metallurgist and Superintendent, Northwest Experiment Station, Bureau of Mines), and Clarence E. Simms (Electrometallurgist, Bureau of Mines)

In recent years much interest has been centered on the possibility of producing alumina from clay, and proposed methods for the recovery of alumina are appearing constantly in parent literature. As a good grade of clay contains from 30 to 40 per cent of alumina, the prospect of recovering it is alluring, although obviously difficult.

A patent typical of many projected thermal processes is that of Paul Miguet (U. S. Patent No. 1,376,563) entitled "Process for the preparation of pure alkaline aluminates."

He proposes to prepare alkaline aluminate by fusing clay, lime, and scrap iron with a reducing agent in the electric furnace thereby reducing the silica and forming calcium aluminate and ferrosilicon. The calcium aluminate, being lighter, would float on top substantially free from foreign oxides. It could then be tapped off, cooled, and later crushed and leached with sodium carbonate solution to form, by double decomposition: sodium aluminate, and calcium carbonate. The former is soluble and yields readily aluminum hydroxide. The ferrosilicon would be recovered as such and sold at a profit. The reactions are supposedly as follows:

(1) $Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O + Fe + 4C + CaO - FeSi_2 + 4CO + CaO \cdot Al_2O_3 + 2H_2O$.

(2) $CaO \cdot Al_2O_3 + Na_2CO_3 - CaCO_3 + Na_2O \cdot Al_2O_3$.

So many reactions similar to the above have been proposed, and it is so popularly believed that alumina can be obtained from clay by fusion, that the Northwest experiment station of the Bureau of Mines at Seattle, Wash., undertook to investigate the Miguet process.

The tests were carried out in a carbon-lined pit furnace of the Girod type having a tap hole to remove the fused material. Clay containing 38 per cent alumina pure air-slaked lime, steel turnings, and gas-retort carbon were used. These materials were finely ground, intimately mixed, wetted, and dried in lumps to avoid dust.

In the first tests the charges were made up with clay, lime, iron, and carbon in theoretical proportions according to the Miguet patent. The charge melted down readily and when melted was tapped. The analysis showed only a slight reduction of silica, and it was thought that possibly insufficient time had been allowed for reduction. The test was therefore repeated, the charge being held molten for a considerable time before tapping. No increase was noted in the amount of silica reduced. When the product was crushed and leached with a hot concentrated solution of sodium carbonate, only a trace of alumina and fully as much ferrous iron was found in solution.

When the proportion of lime was increased, it merely increased the melting point and gave no better product. In these first tests an effort was made to keep within the limits of commercial practicability, but having failed to obtain any favorable results, these restrictions were cast aside and tests were made to determine what was technically possible. The proportion of lime, carbon, and iron to clay was increased to speed up their action on the clay, and the charge after fusion was heated to 1800°C and held for 30 minutes. Still results were unsatisfactory. A charge was then made up with carbon three times and iron twice the theoretical quantity. The purpose was to subject the charge to the most intense reducing conditions possible, and silica is known to reduce more readily in the presence of iron. The charge was melted with the furnace over-powered to such an extent that dense fumes arose. The production obtained was black and stony—hard enough to scratch glass easily. On examination, it was found to contain carbides of calcium, aluminum, and silicon, sillimanite, and quantities of a glassy substance. The analysis showed that about 40 per cent of the silicon had been reduced and alloyed with the iron. The product of this final fusion, when leached with sodium carbonate, gave a recovery of about 30 per cent of the alumina. This alumina produced contained 0.6 per cent SiO_2.

The fact that alumina was actually produced gives some small basis for the claims of the patent, but the prospects of its successful applications are extremely poor. In the first place, to produce alumina by the method of the most favorable test, the cost of the material alone would be more than $300 per ton, as the minimum figure. Moreover, there is no proof that calcium aluminate was formed, because, with so much carbide present, it is just as likely that the sodium aluminate obtained was formed by the decomposition of aluminum carbide and its subsequent solution in the sodium carbonate.

It is certain, too, that silica is not alone in being acted on by the carbon, but that all the other oxides will also be reduced in varying degrees.—*Reports of Investigations, U. S. Bureau of Mines.*

U. S. BUREAU OF MINES CONSULTANT

Mr. W. D. Richardson has accepted an appointment as consultant with the Ceramic Experiment Station, United States Bureau of Mines, Columbus, Ohio. His services are to be utilized in connection with the industrial kiln investigations being carried out by the Bureau.

Mr. Richardson was graduated from Colgate University with the degree of A.B. in 1879 and received his A.M. degree in 1884. Until 1887 he was located with the Columbia School of Mines and for two years he assisted in the chemical laboratory of Dr. Thomas O'Connor Sloane. Three years more were spent in Minnesota manufacturing face brick, then after a short time in St. Louis he located in Ohio. Since that time Mr. Richardson has been managing brick plants and engaged in general consulting practice, designing and building plants. He is best known as a designer of kilns. He was President of the American Ceramic Society in 1906–1907 and continues as a contributor to the technical literature on kilns and kiln burning.

CALENDAR OF CONVENTIONS

American Association of Ice & Refrigeration—Washington, D. C., Probably March 1923.
American Association of Museums—Charleston, S. C., May, 1923.
AMERICAN CERAMIC SOCIETY—Pittsburgh, Pa., Feb. 12–16, 1923.
American Concrete Institute—Cincinnati, Ohio, Jan. 22–25, 1923.
American Engineering Standards Comm.—29 W. 39th St., New York City, Dec. 14, 1922.
American Face Brick Association—West Baden, Ind., Dec. 5–7, 1922.
American Foundrymen's Association—Date not determined.
American Institute of Mining and Metallurgical Engineers—New York City, Feb. 19–22, 1923.
American Malleable Castings Assn.—Cleveland, Ohio, Jan. 9–10, 1923.
American Metric Association—Boston, Mass., Dec. 30, 1922.
American Society of Mechanical Engineers—New York City, Dec. 4–8, 1922.
American Society of Refrigerating Engrs.—New York City, Dec. 4–6, 1922.
American Society for Testing Materials—Place not determined, June 1, 1923.
American Zinc Institute—St. Louis, Mo. or Atlantic City, N. J., First or second Monday in May, 1923.
Association of Scientific Apparatus Makers of the United States of America—Bureau of Standards, Washington, D. C., April 20, 1923.
Canadian National Clay Products Association and Western Ontario Clay Workers Association—Hamilton, Ont., January 24–26, 1923.
Chamber of Commerce of the U. S. A.—Place not determined, Week of May 7, 1923.
International Chamber of Commerce—Rome, Italy, Week of March 19, 1923.
Clay Products Association—Chicago, Ill., Third Tuesday each month.
Common Brick Mfrs. Association of America—Cleveland, Ohio, Week of Feb. 5, 1923.
Dental Manufacturers Club—St. Louis, Mo., November 20, 1922.
Dental Exhibit of the Dental Manufacturers Club—St. Louis, Mo., November 21–24, 1922.

Federated American Engineering Societies—Place not determined, Date not determined.

Manufacturing Chemists Association—New York City, June, 1923.

Mining and Metallurgical Society of America—New York City, December 7–13, 1922.

National Association of Mfrs. of Pressed & Blown Glassware—Pittsburgh, Pa., March 13, 1923.

National Association of Mfrs. of U. S.—New York City, Week of May 14, 1923.

National Association of Stove Mfrs.—Richmond, Va., May 9, 1923.

National Association of Window Glass Mfrs.—Place not determined, Date not determined.

National Association Builders Board of Control—Des Moines, Iowa, February 1923.

National Bottle Mfrs. Association—Atlantic City, N. J., Last of April, 1923.

National Brick Mfrs. Association—Cleveland Ohio, Week of Feb. 5, 1923.

National Canners Association—Atlantic City, N. J., Week of Jan. 22, 1923.

National Exposition of Power and Mechanical Engineering—New York City, December 7–13, 1922.

National Gas Association of America—Louisville, Ky., Spring, 1923.

National Jewelers Board of Trade—New York City, January 18, 1923.

National Paving Brick Mfrs. Assn.—Place not determined, Date not determined.

National Society for Vocational Education—Detroit, Mich., November 30–December 2, 1922.

Portland Cement Association—Chicago, Ill., November 20–22, 1922.

Refractories Manufacturers Assn.—White Sulphur Springs, W. Va., Nov. 2–3.

Sanitary Potters Association—Pittsburgh, Pa., Monthly Meetings.

Stoker Mfrs. Association—Hot Springs, Va., November 21–23, 1922 (fall meeting) May or June, 1923 (annual). Place not determined.

Taylor Society—New York City, November 23–25, 1922.

Tile Manufacturers Credit Assn.—Beaver Falls, Pa., Quarterly Meetings.

U. S. Potters Association—Probably Washington, D. C., December 10, 1922.

BULLETIN

of the

American Ceramic Society

A Monthly Publication Devoted to Proceedings
of the Society, Discussions of Plant Problems, Discussions
of Technical and Scientific Questions and
Promotion of Coöperative Research

Edited by the Secretary of the Society Assisted by Officers of the Industrial Divisions

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Vol. 1 December, 1922 No. 12

EDITORIAL

INDIVIDUALISM vs. COÖPERATION

The time is within the memories of many living when man was very much more dependent on hand labor in all things, and when traveling, even across town, was tedious and news was carried mostly by couriers. Under these circumstances there was very little of collective labor and practically no industrial coöperation. In comparison with the present there was, one or two generations ago, very little mutual dependency of man industrially. But with the possibilities and necessities of men working in organized groups brought about by machinery and process inventions, men became more and more dependent upon their fellows.

The affairs of man are becoming more complex with each passing year making more pronounced this mutual dependency. This is reflected in the many and increasing numbers of commissions appointed to adjust affairs between capital and labor. The prosperities and adversities of one state in the Union are shared by all to an increasing degree with each passing year. The prosperities and adversities of the "Far East," of Russia and of all lands are reflected in the affairs of this country to a greater and greater extent each succeeding year. Mutual dependency is becoming more evident.

Displacement of hand labor by machine methods has brought the industries from the home shops into factories and the more rapid and dependable means of communication have caused the individual factories to combine into still larger industrial groups. The side hill coke ovens

and lime kilns of individual farmers are now rarities if not wholly extinct and the small hand brick yard is an economic impossibility. In spite of our natural aversion to the "wicked combines" and to the "large financial interests," these must be recognized as legitimate products of the increasing complex industrial conditions. They are the inevitable results of big machinery and improved methods giving larger production.

Trade and technical associations, industrial research laboratories, federal bureaus, semi-public research institutes, research councils of each industrial nation and the more recent international councils are not fads but are the natural means suggested by the increased complexity of industrial affairs which in turn calls for organized coöperation.

The consequences of attempts to eradicate "trusts" and "big financial interests" by resolving the industries back to the state of individualism are to be seen in Russia. Communism that involves the dissolution of stock companies, big or little, has always resulted in demoralization. Coöperation of concerns through Associations is the only communism that will meet the requirements brought about by the modern equipment and methods for manufacturing and transportation.

Continued industrial prosperity will require either larger "combines" and more of them or more intimate coöperation through associations. Failure to support these associations is a failure to provide the means of manufacturing by concerns of relatively small capitalization.

The American Ceramic Society gives the opportunity for organized coöperation of ceramic industries to promote their technical, scientific and artistic welfare. Next February in Pittsburgh recognition will be given to the foresightedness of that group of twenty-one pioneers, who, under the leadership of Professor Edward Orton, Jr., twenty-five years ago organized this ceramic technical and scientific Society.

Ceramic industries are coöperating in technical and scientific research much more today than heretofore but there is yet a great deal of harmful prejudice against the sharing of information. The ceramic industries have not yet reached the stage where several concerns will pool their scientific knowledge of materials, mixtures and processes as do some of the concerns in other industries.

It is the policy of this Society to preach and to practice coöperation in things technical, scientific and artistic. When the conventions of trade associations and associations of users of ceramic products, and when the trade papers and journals are filled with reports of researches on ceramic problems, this Society will have realized the ideal. It is to this end that we are working.

Individualism in industrial, scientific and artistic ceramics is essential but to a larger degree today than at any time past there is need for more intimate coöperation.

DISCUSSION[1] ON "BEST TYPE OF CROWNS TO BE USED OVER GLASS TANKS"

MR. KNOTHE:—There is apparently no certain answer or solution at present to the question of the best type of crowns to be used over glass tanks. The suggestion of using a flat crown under the furnace has been made several times. Often the opinion has been advanced that a tank furnace is too large a unit for that type of construction to be feasible. From a mechanical standpoint it is entirely practicable to build a flat crown on a furnace.

MR. HOSTETTER, CHAIRMAN:—You have had experience or some suggestions along that line?

MR. KNOTHE:—We have worked up a design for that type of furnace. It has not been tried out yet, and I am not in a position to say what can be expected but it is believed that the furnace can be built and made practical from a mechanical point of view.

MR. CRUIKSHANK:—The Murphy Iron Works have used the flat type of arch in the furnaces under boilers. They use rectangular blocks provided with tee-headed slots in their upper surface by means of which they can be suspended by bolts to beams running across the furnace. The design is patented by them. The device has been very successfully used in boiler furnaces as it confines the heat as well as brings the top of the furnaces closer to the boiler tubes and thus economizes space. Another decided advantage is the facility for renewing anyone of the blocks. The only difficulty I can see in the use of such a cover over melting furnaces is that there would be a tendency for the joints to open, whereas with the ordinary arch held by buckstaves the brick are held tight together and there is no possibility of leakage of gases through the crown. With the suspended flat blocks the arch effect is done away with.

THE CHAIRMAN:—The flat arch would have one advantage, that of a smaller surface to radiate. What other advantages would you suggest that it would have?

MR. KNOTHE:—A flat arch could be repaired in spots without disturbing any of the rest of the arch.

DISCUSSION[2] ON "ABSTRACTING AND PUBLISHING DATA OF VALUE FOR GLASS-RESEARCH LABORATORIES"

MR. HOSTETTER:—This subject is listed in the program as "Possibilities of Having Records of Each Industrial Glass-Research Laboratory Systematically Examined with View to Abstracting Data of Value and Publishing the Same." The National Research Council is collecting data of that type wherever possible to secure it and we have had requests from

[1] Glass Division, St. Louis Meeting, Feb. 1922.

[2] Glass Division, St. Louis Meeting, Feb., 1922.

the Council along this line. It is a question of getting time to dig through the files and get it out for them. I think it is a desirable thing that if we can get fundamental data from the research laboratories dealing with these questions, to get that material in form available for the industry. Probably those of you in laboratories from glass houses around the country have had similar requests from the National Research Council. In connection with research in glass I would like to call your attention to a report in the Year Book of the American Ceramic Society, in which the Committee on Coöperative Research, Glass Division of the American Ceramic Society, in the National Research Council, have proposed subjects for research on Glass Technology proper: (1) *Physical Properties of Glass:* Viscosity of molten glass, especially factory methods for determination; surface tension of molten glass, especially factory methods for determination; density of molten glass, especially factory methods for determination; (2) *Chemical Studies on Glass:* Correlation of physical properties with composition; reactions taking place in glass manufacture, with especial reference to the rate of evolution of gas; gases dissolved in glass; effect of temperature and duration of fining; effect of chemical composition; development of colored glasses; manufacturing problems; correlation of fining temperatures with physical properties; study of methods of furnace control, such as devices for measurement of temperature, of velocity of gas, air rate and completeness of combustion; (3) *Problems of Furnace Construction (Refractories):* improved material for tank walls; effect of special cements and coatings on furnace and tank life and efficiency; furnace and tank design.

This is submitted without much comment, and it would be helpful indeed if we could get laboratories equipped for doing this work such as the Bureau of Standards and Mellon Institute to set about this in a systematic manner, and get at some of these problems. If other companies were to establish industrial fellowships as Corning Glass Works has with Doctor Washburn at a cost of a thousand dollars per annum, half-time service, they would soon make fast strides in really knowing why and how to do certain things.

DISCUSSION ON "WHY ARE OPEN POTS USED IN EUROPE AND NOT IN THE U. S.?"[1]

MR. HOSTETTER, CHAIRMAN:—The question of "Why Are Open Pots Used in Europe and not in the United States?" My impression was that we use in this country both open and closed pots. Yesterday Mr. Bellamy cited literature to the effect that it was impracticable to lay glass in contact with flames in open pots. When we started to make optical glass in this country we were very much worried about making dense

[1] Glass Division, St. Louis Meeting, Feb., 1922.

flint glass in open pots. We finally got up to lead glass, 55% lead oxide in open pots, and in the course of melting hundreds of pots of glass, containing about 45% oxide I have never seen indications due to the reduction of lead. Occasionally a water cooler would break and get some metal in the pot such as a chunk of iron, but no discoloration as far as we could work out took place from the reduction of lead by the flames. Has anyone experience along similar lines?

MR. WRIGHT:—I have talked to a few glass-makers who came from foreign countries, and they have often spoken of open pots in the furnaces, where they fill in the pots and melt over night, and the following day cool down the furnace and work from those pots. They were making a periodic operation either every day or every other day from these furnaces. In this country most of the glass furnaces maintain a melting heat all the time so that when the glass pot is filled in and finally melted the pot glass can be moved by removing the stopper without reducing the temperature of the melting unit.

MR. FORSYTH:—I would like to have you ask Dr. Hess what he knows on the subject, especially about the practice in Holland in melting in these open pots.

DR. HESS:—England, Holland and Germany use small open pots on lead glass. The matter of open pots for lead glass depends very much on the size of the pot and the area. It is perfectly feasible to melt lead glass in open pots with absolute success. In optical glass, for instance, up to a definite size you have found that that could be done; and in the early days on the bulb machines we were trying to work tanks on lead glass. We had some very interesting and peculiar results. Quite frequently we would get a very good glass. We were working by hand at that time the same as if we were working in the pots now and sometimes we would get a run of beautiful glass for an hour or two. Often, however, for a half-day, a half-month or a month we would not get glass that was clear. The greatest trouble there seemed to be the flowing of the different densities of glass over the surface of the tank. The glass of a lighter specific gravity would flow over the top, and it would pull with it the heavier glass from the bottom. It might be that a device inserted into the tank for stirring might help matters. We have done some experimental work along these lines and found we could handle it, but it has not been wholly satisfactory. In relation to the open pots, it is a question of a different system of working. They work at one time and melt at another; they make their melt over night, and work in the daytime. But they work much smaller pots than we do and they find it impossible to work and melt at the same time. There is no question but that a great deal of work can be done on the closed pots if proper conditions of flame and temperature are developed. You have to be exceptionally careful and not have a tem-

perature raise while working lead glass. A temperature raise always gives trouble. You have all heard that you could not make ruby glass in tanks, but that is an exploded theory. I have also seen people make ruby glass in pots and seal the pot so thoroughly that it has blown the crown off by reason of the accumulated gas pressure. I do not think there is any difficulty in making ruby glass in tanks or lead glass in open pots but when you come to a certain size definite mechanical features must be introduced.

THE CHAIRMAN:—Are these gold rubies or selenium rubies?

DR. HESS:—Both gold and selenium rubies.

MR. WRIGHT:—I would like to raise a question here on ruby glass. Dr. Hess made a statement about causing the gas to press out through the crown. Was that the pressure of gases?

DR. HESS:—That was a case of there being no escape for the gas. It was simply a condition developed on the part of the caretaker of the furnace.

MR. WRIGHT:—Do they not retain a certain quantity of those gases which are lost in the tank?

DR. HESS:—I produced the same color from the same batch in both tank and closed pot. Faster melting seemed to give me better results from the slower melting.

THE CHAIRMAN:—Mr. Bellamy, what rubies did you melt in that small tank?

MR. BELLAMY:—Gold rubies only.

MR. HOSTETTER:—I do not know of any furnace in existence in this country of the circular type in which open pots are used. Does anyone know of any European styles that are in existence in this country? It may be that investigation will show there is a real economy in getting quicker melts and lowering them the next day. Certainly with the open pot you secure much more rapid melting than in the covered pot.

DR. HESS:—I think in a great many cases they have not used an open pot entirely. A removable cover was used such as we had in the crown of the pot. This was removed to facilitate the melting and during working time closed up, so that the flame would not blow in on the surface of the glass. This is necessary when working and melting at the same time.

MR. HOSTETTER:—I have used those. They work out all right.

MR. FORSYTH:—In talking with some men from Holland who operated the open pot, they brought up the point that in working out these open pots, it was very much hotter than working out of the closed pots; and that our workmen might perhaps raise some objection on that point.

MR. HOSTETTER:—No doubt they would in this country.

MR. GRAFTON:—The only place that I know where they work the open pots in colored glass is in the Johnson Glass Company of Hartford

City, Indiana. They have a small furnace containing four pots, a burner in the center radiating heat, and flues in each corner of the furnace built on the style of a pot arch. I cannot give you very much information in regard to the furnace but anyone interested in the subject, could write to George Fulton of Hartford City, Indiana. I am sure he will give you the information you desire regarding the melting in open pots.

DISCUSSION[1] ON "GLASS CONTAINERS"[2]

MR. WILLIAMS:—The Glass Containers' Association has started a Fellowship at the Bureau of Standards and we have one man working. I have given a great deal of time and attention to that work myself. The problem which we thought would be the most interesting to the greatest number of the glass manufacturers was some scheme for preventing the weathering or scumming on the ware in storage, which causes considerable loss to everyone. We are also working on the properties of glass with respect to use for food-packing and canning, to be used in place of the tin can containers. It is desirable to get a method and apparatus more suitable to the physical properties of glass.

MR. HOSTETTER:—Mr. Williams evidently has been dealing with some glasses that are very unstable. I think all of us have had experience at times with glass and know the troubles we have had with them before we could ship them to our customers. The stability of glass is a very important field for investigation. Aside from this, however, there are many problems involved in the manufacture and use of glass containers, for instance, the packing of carbonate water. We have there the possible action by CO_2. Dr. Bitting has told me that ginger ale was packed in glass and shipped to distributing points. The breakage in transportation to the distributing points was very small. After six weeks' storage the breakage had increased greatly as compared with the first breakage, due presumably to the fact that the glass was subjected to fatigue, having, been exposed for this period of time to high internal pressure of carbon dioxide. The work of the Containers' Association of which Dr. Bitting is Director of Research is extremely important and this Division should certainly work in close coöperation with them wherever possible.

The question of the strength of glass stability in contact with foods of various kinds, as well as the weathering in the air are matters to be considered.

Mr. Williams showed pictures[3] of some milk bottles that were weathered

[1] Glass Division, St. Louis Meeting, Feb., 1922.

[2] Bitting, *Jour. Amer. Ceram. Soc.*, **5**, 85 (1922); Ford, *ibid.*, **5**, 837 (1922).

[3] See Williams, "Disintegration of Soda Lime Glasses in Water," *ibid.*, **5**, 504 (1922).

very badly. The statement was made that the average life of a milk bottle was something like five trips.

MR. FORSYTH:—Three.

MR. HOSTETTER:—Mr. Forsyth says it is three trips but five is the lowest number I had been informed of.

MR. WILLIAMS:—The National Dairymen's Association, as far as they have gone, show that the life of a milk bottle is thirty days.

MR. FORSYTH:—My only information was the statement made during the milk controversy in Cleveland by one of the largest milk concerns there. It might have been a little advertising policy. I asked one dairyman about it. It is only one case and not an average case. He said they averaged eight trips.

MR. HOSTETTER:—It is surprisingly low, whether it is three or eight. We certainly ought to develop glass that would stand up a longer period than that.

MR. WILLIAMS:—You cannot blame that all on rough handling of the dealer and the user; sterilization of the bottles and sudden heating in the winter time affect the life of the bottle. I have been in dairies where they were washing bottles and noticed incipient cracks, very small and hardly noticeable when the bottles are cold. Those bottles are naturally weakened and the second time they are washed the crush grows a little more although the final break may come in handling. Milk bottles are very strong and will stand quite a blow when they are new, but glass seems to suffer from fatigue as much as metal and the breakdown is not altogether due to the rough handling.

MR. YUNG:—The glass companies have quite a job on their hands if they are going to combat the work of the Glass Container people themselves, for they are having quite a campaign now. Every paper that comes out fosters the use of glass containers. Not long ago, I read a paper where they advised the glass people to smash all the bottles they could get their hands on. They went so far as to advise all their traveling men and anybody connected with the industry to ask in the hotels for all the condiments, such as catsup, in bottles so as to create a greater amount of breakage, by having them handled oftener. It seems to me we should have something to make the bottle stand up, if they are working another combination for destruction.

MR. HOSTETTER:—Has anybody any knowledge as to the relation between "weathering" and "strain" in the glass? Is strained glass more subject to corrosion than glass properly annealed.

MR. YUNG:—Some work done on case-hardening may help on that. The straining of the glass showed something to the effect that the glass container or dish which was case-hardened was less attacked than one which was annealed and the weathering that was shown was by the cutting

of the external surface. A case-hardened piece of glass has a surface under intense compression, and it seems that that compressed surface is more resistant to corrosion than that with a cut or broken surface underneath.

MR. HOSTETTER:—Would you go so far as to say that if you had a surface in tension it would be attacked more rapidly than one in compression? Would you say that there was any degree of strain, positive or negative?

MR. YUNG:—I do not know that it necessarily was a compression of the surface. The experiments were not carried out far enough.

MR. HOSTETTER:—The plate glass people, for instance, maintain that their glass as cast is more resisting than after it has been ground and polished.

MR. FULTON:—I think they are right in that.

MR. BROWN:—I can state positively that glass which has been ground after it has been cast has nothing like the resistance to weathering like glass as cast.

MR. WILLIAMS:—In our numerous tests by treating glass in boiling water or in an autoclave the original glass surface is always more resistant to corrosion than merely fractured edges or ground surfaces. Whether these surfaces are in compression or tension, I do not know, but I do believe that they are in equilibrium with the interior.

MR. GOODMAN:—I should like to know if anyone has any formation on the subject of the weathering of glass. In opening up some large glasses that were packed in cartons, there were corrugations formed, a white film on the glass. Is there anything on the cardboard that would cause that to be affected with these corrugations?

MR. PAYNE:—We have noticed this several times and have found it was just from the warehouse, or coming from the paper, but we are not familiar with the actual markings of weathering where the ware was in contact with paper.

MR. WILLIAMS:—Was that the marking on the exterior of the bottle or interior?

MR. GOODMAN:—The entire glass had a white film and could be seen along where the bottle and the article touched the corrugations. You could see the corrugated marks.

MR. WILLIAMS:—It is very rare indeed to see scumming on the exterior of a container. It is always on the interior where the evaporation goes on much slower. That is the reason for it. Those corrugations might have been dust and dirt. Did you try to wash them off?

MR. GOODMAN:—Yes.

MR. WILLIAMS:—Then it was probably the weathering.

MR. GOODMAN:—We have noticed that in taking some articles and putting them outside of the cardboard cartons, nothing happens to them, but

when we place them in the carton and leave them there a while we see the corrugation marks on the glass.

MR. BROWN:—The question of weathering bottles resolves itself into one similar to any other kind of a question of glass: that is the question of moisture. CO_2 moisture apparently has no effect, and in these bottles, I have seen a case where the ridge itself absorbed the moisture.

MR. WILLIAMS:—When you make a survey of the weathering proposition, you will find all types of soda lime glass from the highest to the lowest, affected with the phenomena of scumming in storage. Therefore, in trying to find the method of obviating the occurrence of this it looks as though it might be a proposition of trying to avoid scumming by getting the right method of storage rather than correcting the composition since we have it in plate glass and window glass, and also in all types of bottles. Consequently, it may occur in glasses having a wide variety in composition under certain conditions of storage.

MR. HOSTETTER:—Unfortunately we cannot always have the storage facilities desired. I am reminded of the remark of Mr. Dixon in regard to the stability of glass when salt cake is used in the batch. Glass of the crown type can retain in solution considerable proportions of both chloride and sulphate, and perhaps the presence of the sulphate acts as a stabilizer to some extent.

There is an interesting thing in connection with weathering that occurs in glass used in lampworking. Glass that has stood around for many years will have a weathered film over the surface. When this glass is heated in a blow-pipe flame it cracks very readily. There are two means of avoiding this difficulty: One is to dry, wash off the weathered film on the glass with hydrofluoric acid and the second is to introduce sodium vapor into the flame which in turn will act on this surface film and restore it to the original condition.

MR. BROWN:—Does that idea hold as well on boricsilicate as sodium lime?

MR. HOSTETTER:—I can't tell you that. Mr. Forsyth says to some extent it will work.

DISCUSSION ON "FINE OR COARSE-GROUND MIXTURES FOR CHECKER BRICK IN GLASS FURNACES"[1]

MR. ZOPFI:—I know nothing about this subject from practical experience, but it occurred to me that there might have been some of the members who have conducted an investigation along these lines, on whether fine ground checker brick, due to its structure will absorb and give off heat more rapidly than a coarse-ground brick.

[1] Glass Division, St. Louis Meeting, Feb., 1922.

MR. HOSTETTER:—The spacing of bricks in checkers is highly important. It has not been given sufficient consideration in furnace design. Heat transfusion is a function of the velocity of the gas and that in turn depends upon the spacing of the checkers and the pressure under which the furnace is operated. That end of it has received some consideration, but the question of the texture of the actual brick in the checkers is before us now.

MR. ZOPFI:—The impression I had in reference to checker brick has been that a great many glass manufacturers insist that the checker brick be a very coarse-ground mixture with the idea that heat will penetrate very much more rapidly and give off more rapidly than will the fine-ground brick. We are inclined to question this, though we have had no actual demonstration in a glass house checker. A glass melting pot of fine texture will melt quicker than one of coarse grain and for that reason we believe that the checker brick of fine-grain clay mix is better than the coarse grain.

A MEMBER:—Is there any differentiation between the density due to vitrification and density due to finer-grained mixtures, *i. e.*, is the dense texture which you have in mind due to the mixture of grog and clay, or to the degree of vitrification or to both?

MR. ZOPFI:—I would say that the density was due to both the degree of vitrification and size of grog, but the density or structure due to amount and size of grog would be the most important.

MR. FULTON:—I have no knowledge of any tests covering the subject brought up by Mr. Zopfi, but it has been the general practice to use coarse-grained brick for checkers. The reason held for this is that a coarse open texture brick will withstand repeated heating and cooling and will have less tendency to spall than a brick of fine dense texture.

MR. HOSTETTER:—That is true unless they were made out of zirconium silicate.

MR. BROWN:—That has been my experience too.

MR. FORSYTH:—It looks to me as if there has been no actual demonstration of the fact that the dense brick would spall under those conditions. After old checker brick are well glazed and rendered fairly dense we have noticed spalling.

MR. FULTON:—I know of one experiment where silica brick was used for the top courses of the checkers in an effort to prevent the collection of dust at this location. In this respect the experiment was a success but the fluxes carried into the checkers attacked the silica brick very rapidly and after a very short period more than half of each brick was washed away. While silica brick has a strong tendency to spall, these brick when removed showed a dense glazed surface and there was no evidence of spalling.

DISCUSSION ON "THE INFLUENCE OF HEAT ON THE MICROSCOPIC PROPERTIES OF SILICA IN ITS DIFFERENT MINERAL FORMS"[1]

By Herbert Insley:—Mr. Robson's article is apparently based on the assumption that there is a gradual change from one polymorphic modification of SiO_2 to another, *i. e.*, that the physical properties of quartz change gradually when it inverts to tridymite or cristobalite and that the process of inversion can be stopped at an intermediate point and there the physical properties such as index of refraction will be found intermediate between those of the two crystalline modifications. Such a conception of the mechanics of polymorphic change is contrary, as far as I know, to any modern theories.

Table II in Mr. Robson's article gives the index of refraction of quartz as 1.545 before heating and as 1.517 after heating to cone 14. The author explains this change in the following sentence: "No effect is noticed in the case of either sand or quartz on the index at cone 13, about 1390°C, but at cone 14, about 1410°C, a decided drop has taken place in the indices of both substances, showing that above cone 13 both sand and quartz tend to transform into cristobalite, which has an index of refraction of 1.487." The above statement seems to imply that 1.517 is the index of refraction of a pure homogeneous crystalline modification of SiO_2 with physical properties between those of quartz and cristobalite.

Unfortunately the methods of examination were not given in detail, but it seems probable that the particles examined microscopically after heating to determine the index of refraction were not homogeneous but were intimate mixtures of quartz and cristobalite which gave values for the index of refraction somewhere between the true values of quartz and cristobalite. If this is the case it is dangerous to base estimates of the percentage of the whole sample inverted to cristobalite on the index of refraction of single aggregates which very probably are not representative of the sample.

The conclusion reached by the author, "that French flint and chalcedony both transform into cristobalite before sand and quartz," may be true but the article under discussion does not prove it for the conception of the mechanics of crystalline transformation on which the conclusion is based is not the generally accepted one and has not been proved.

Mineral Forms

By Mr. Robson:—In answer to Mr. Insley's discussion the writer wishes to state that he is of the opinion that there is a gradual change in the aggregate from one polymorphic modification of SiO_2 to another.

[1] J. T. Robson, *Jour. Amer. Ceram. Soc.*, 5, 670 (1922).

Of course there is not a gradual change from one form to another in the discrete particles of the aggregate, as is well known, but all the discrete particles do not transform at the same time and hence the aggregate mass which is what is seen under the microscope will be made up of changed and unchanged discrete particles which altogether will give this aggregate an intermediate index of refraction such as claimed by the author. This phenomena of gradual polymorphic transformation of the aggregate is shown by Spotts McDowell[1] where he gives a table showing the effect of repeated burning upon the constitution of silica brick. A portion of this table illustrating this gradual change follows:

Mineral	Number of burns 1	3
	Volume per cent	
Quartz (and silicates)	25	12
Cristobalite	71	58
Tridymite	4	30

Note the decrease in the volume of quartz after the third burn, likewise the variation in volume of cristobalite and tridymite.

In our laboratory we have a sample of sand which has gone through the glost kiln of a tile plant. When immersed in oil of 1.545 index (that of quartz) this sample has high relief, when immersed in any other oil as 1.487 index (that of cristobalite) the grains still have high relief. This is explained by the fact that a thin skin or shell of cristobalite has formed on the outside of the quartz and when immersed in oil of 1.545 index the cristobalite shows then and *vice versa*, when placed in oil of 1.487 index, the quartz causes a high relief in the oil so that the cristobalite cannot be determined.

However, when these grains are crushed in a mortar, the cristobalite shell index and quartz index can be determined readily.

In reply to Mr. Insley's statement, "It is dangerous to lose estimates of the percentage of the whole sample inverted to cristobalite on the index of refraction of single aggregates which very probably are not representative of the sample," I would call attention to the statement by Posnjok and Merwin.

By calculating as nearly as possible the volumes of the various impurities and assuming the additive relations for refractive index, the calculated mean refractive indices for several analyzed specimens have been found. Comparison of them with the observed values is found in Table IV.

In view of the above prescribed mode of precedure by these authorities, the writer feels absolutely justified in drawing the conclusions to which Mr. Insley objects.

[1] "A Study of Silica Refractories," *Trans. Amer. Inst. Mining Eng.*, **57**, 43 (1918).

TABLE IV

No.	Mean refractive index, calculated from analyses	Mean refractive index, measured
9	2.28_6	2.30
10	2.27_2	2.28
13	2.22_5	2.21
14	2.22_2	2.19
15	2.20_2	2.19
16	2.17_8	2.17
17	2.16_8	2.17
18	2.11_7	2.12

The writer wishes to make it clear that he does not claim that there is a pure homogeneous crystalline modification of silica with physical properties between those of quartz and cristobalite as Mr. Insley infers but that the aggregates do have an index corresponding to the mean indices of the discrete particles of which it is constituted.

The writer also believes that the conclusion reached that French flint and chalcedony both completely transform into cristobalite before sand and quartz is correct.

DISCUSSION[1] OF "ITEMS OF COST FREQUENTLY OVERLOOKED"[2]

MR. D. F. STEVENS:—For several years, most of the heavy clay products industries have alternatingly experienced a condition of no business, or so much business that costs did not make very much difference, but we are now probably in a period of considerable duration in which costs are going to become of vital importance.

There will be increasing demands for brick and tile but not a sufficient demand for a long time to come to absorb the full capacity production. Therefore the manufacturer who has his costs under the best control and is most accurate is going to have a great advantage over one who has an inadequate record of his costs.

Emphasis is often placed on the various items of expense but to arrive at a cost rate, we must have not only the items of expense but also the quantity of ware produced by which to divide these expense items and thus obtain the rate. That is where a great many men are deceiving themselves.

The total amount of green ware produced at the machine is often considered as the production of the plant, and the various items of expense are divided by this figure. As a matter of fact even before the ware is on the dryer cars there is a certain amount of damage which would result either in off-grade ware or absolutely unsalable ware. Such items of

[1] Heavy Clay Products Division, St. Louis Meeting, Feb., 1922.

[2] Owens, *Jour. Amer. Ceram. Soc.*, **5** (Bull. Sec.), 48, 1922.

loss pyramid in geometrical ratio if not itemized at each stage through the process. Very few plants make any particular effort to determine the loss and depreciation in manufactured ware as it progresses through the factory.

It is practically impossible to operate a dryer of any type without a certain amount of ware coming through damaged. Some of this will be rejected by the setters but some will be set.

Many face-brick manufacturers keep account of the number of damaged brick coming back to the machine for a short time. If the conditions remain constant so that the same amount of damaged ware will be returned each day, a constant percentage can be used in the cost determination and the manufacturer can do without the daily records of damaged ware. But the amount of ware thus returned is usually not constant. In our own case it varies to a certain extent with weather conditions and more with the conditions of our raw material. Different parts of the vein will produce more brick loss than others. We decided that it would pay to keep an exact record on every damaged brick at each stage in the manufacture, with statement of the cause.

In the case of face brick each car is a unit, hence it is easy from day to day to determine just exactly what our dryer loss is. After the ware is set, burned and drawn, we obtain records of kiln losses.

Mr. Farnham spoke of the fact that with piece work many times there will be no loss shown whatever and that there will be more good ware coming out of the kilns than was set. We operate our plant on piece work, and I know that this condition is painfully true. The only accurate way to avoid this is to count the cullage when the kilns are cleaned. If you do not want to count each individual brick, the number of wheelbarrows could be used.

In piling the ware in the yard and later when loading it, a certain amount of loss will occur which should be known.

These various leaks, each one not very great, over a period of time amount to a great sum. The total of these losses should be deducted from the machine count of the ware produced to arrive at the proper divisor to be used in determining cost rates.

Another factor of even greater importance is the loss through off-grades. Many manufacturers do not stop to consider that their off-grade ware must be sold at a small fraction of the production cost although the cost of production is just as much. It has required the same amount of fuel, labor and overhead and yet must be disposed of at a very low price, and in many cases must go to the dump. The first-grade ware must carry the loss incident to the manufacture and sale of the off-grade ware.

The most convenient and satisfactory way to arrive at a selling price for first-grade ware is to carry all off-grade ware at a low inventory rate

and then charge the difference between this and the cost of production for the period under consideration against your first-grade ware. That, of course, will materially increase the cost of your first-grade ware, but you will know that you are selling your first grade at a profit and taking care of the loss which otherwise you would incur in the sale of your off-grade ware.

I believe this is the simplest and the surest accounting system. From the standpoint of income tax returns it is the safest because it automatically carries the inventory at a deflated figure.

These two particular lines of expense, (1) loss in broken and defective ware coming through the various processes of manufacture and, (2) the off-grade ware which has to be sold at a very much less price, are frequently overlooked. Manufacturers who do not take these losses into account will think they are operating at a profit whereas actually they may be operating at a very considerable loss.

A MEMBER:—How many bricks do you put on a car, Mr. Stevens?

MR. STEVENS:—We average about 500.

A MEMBER:—Do you carry any extra brick to make up for the loss of the breakage?

MR. STEVENS:—I think the actual count of our brick is 504, and we carry the cars as 500, but we keep track of the actual loss at each stage.

A MEMBER:—We figure about 600 for the car and put on 16 extra brick. All of the breakage from the kiln is collected and weighed. We have a hopper on the return tracks to the machine in which we weigh the bricks damaged prior to burning. When we empty the kilns we clean out and weigh the waste.

MR. STEVENS:—If you are making all your product the same weight, weighing is just as well as an actual count.

MR. W. H. HERBERT (Nashville):—A short while ago I asked the transfer man to give me an accurate count of the number of broken brick on a certain number of cars. I checked this up with him and found he was turning in the number of bads as the number of brick; he had twice as many bads as he had of brick.

MR. STEVENS:—The Indiana white labor on the whole have that same degree of mentality. It is pretty hard to check them up by a count. Our records at the end of the year will be out about 200,000 brick.

MR. LANGWORTHY:—We do the same thing. Our cars hold about 500, but they fall short of that because the machine fellows are on piece work so we count 470 to the car although it figures a little bit more than this. We make seventy cars for 33,000 brick.

We also keep track of the number of bricks broken in the dryer. We call it the dryer loss, but we do not take that into account because at

the end of the year we have about 200,000 extra brick on the plant to inventory.

A MEMBER:—We do not; that 30 brick on a car covers all of our loss—the dryer loss and the kiln loss also.

MR. STEVENS:—That will run about 6%.

MR. LANGWORTHY:—But we set those extra brick. The machine men make the extra brick and the setters set them and the drawers draw them.

MR. W. H. HERBERT:—We manufacture dry pressed brick. We had a revolving counter on the machine, counting the number of bricks the machine made. As we had to assume the loss, we finally gave that up and now we count the actual bricks that go to the kiln.

MR. STEVENS:—How do you count the bricks?

MR. HERBERT:—We have a board set up near the truck. This pushes a lever which operates a counter.

MR. STEVENS:—I was talking to a manufacturer recently who told me of a friend who wanted to get the exact count to prevent the men from cheating, and they installed a checking device so that when the car loaded with ware went over this section of the track, it rang a little bell and made a record in the office.

The manager happened to be in the office one day and heard the bell ring. A very short time after that he heard it ring again, and he did not see how in the world they could have filled another car that quickly so he slipped out to the machine room and around behind the door and listened. The car was run through and then in a very short while a fellow hit this device with a sledge which would positively ring and mark up another car. That is one serious disadvantage in having the machine room on a piece work basis.

We tried that for several years and had to give it up and went back to day work because of the tendency to slight, if not actually to miscount, and at least to put defective ware on the cars. Once you get your defective ware on the dryer cars it is very difficult to eliminate them afterwards. They will be put into the kiln and share with the good brick the expense of burning and the cost of space occupied. With day work this is not so likely to happen. We are making a rather high-grade ware, and the question of quality is vital, so in our case day work makes our machine-room cost a little bit higher.

We have a monthly bonus which we give the machine-room men for steady working which does not depend on any particular day's run. This gives them an incentive to stay on the job and keep things going in good shape. Problems of that sort vary with individual conditions.

MR. POTTS:—Do you put holes in your bricks?

MR. STEVENS:—Yes.

MR. POTTS:—Three or two?

Mr. Stevens:—Two, about $1^1/_8$ inches apart. Of course, the number of holes and their spacing would vary with the clay; some clay will stand an inch and a half hole, and others will not stand an inch. Recently we changed to two holes instead of three to decrease the breakage.

Whether it is a peculiarity of our material or not, I do not know, but with two holes we get less breakage than with three smaller ones. It is true that the brick will not break half as easy with two holes.

Mr. Greer:—There is one question that seems to me fundamental, and that is the unit basis for cost figuring, whether it should be the ton or thousands of brick.

It seems to me that the ton basis is the only definite basis of costs. It is the only factor that can be applied against ware of all varieties, particularly heavy bricks.

Mr. Stevens:—I think there is a good deal to what Mr. Greer says about costs varying practically in direct proportion with the weight.

We make two different styles of rough face, and one of smooth face and the weight will vary somewhat, but the various items of cost, with the possible exception of fuel, are not in proportion to the weight at all, but are in proportion to the number of bricks produced. In other words, some of our bricks that weigh about $4^1/_2$ pounds will actually cost us practically as much as a brick that weighs about 5 pounds, and the same thing is true with our floor tile. The smallest size of floor tile is 3″ x 6″, and the largest is 6″ x 9″.

The 4″ x 4″ tile involves just as much handling and just as much expense, with the possible exception of fuel, as the 6″ x 9″ tile, hence we found it was more convenient to just count the number of individual units. I can very readily see that in the case of heavier ware, such as sewer pipe and drain tile, the tonnage basis would be better.

Mr. Potts:—I always prefer a tonnage basis, because it is the only common medium. If you are making a line of drain tile from 4 to 12 inches, and a line of fire proofing up to 12 by 12 inches, you can have no other means of comparison than on the tonnage basis.

Mr. Amos:—I do not know that I can agree with either of these gentlemen. I am operating two plants combined. The shale goes to one set of bins for hollow tile and another set of bins for brick. We figure our brick costs by the thousand and, as Mr. Stevens says, the weight of the bricks makes no difference in their cost of manufacturing. You can make brick of four or of five pounds and a half, just about as cheap as you can make a brick that is smaller.

Of course, in making paving blocks, weighing eight pounds, there would be quite a difference in that cost, but as long as there is very little difference in the bulk of the brick, the difference in the weight of the brick makes practically no difference in the cost, except as to fuel.

Large, heavy brick, as a rule, will cost a little more to burn than a smaller, lighter brick. In our hollow tile plant we figure costs on the ton basis, and the service rendered to both plants in the shale pits and the power is divided between the two on a tonnage basis.

MR. TEFFT:—We make quite a few shape brick, and anything under the size of a standard brick is given a standard brick equivalent, we call it S. B. E. unit. Anything over that in a shape is given whatever the volume would be, of one and a third, one and a half or possibly two. We make some brick that would be large enough to take even a six S. B. E.

MR. DAILEY:—There is no doubt but that the question of keeping an accurate record of the production of the various departments is just as essential as accuracy in our books of account. No matter how careful we are, discrepancies will appear in our records of machine-run ware dried and set, and ware drawn from the kilns. Our aim though, is to keep these discrepancies as low as is practicable without a too burdensome system of checking. We keep our production record for these different departments by days and months and we also keep a record of each kiln showing the input and output. Just as soon as any differences other than reasonable ones occur we immediately set about correcting them.

A manufacturer considered he was producing 5,000 tons of ware per month in his plant. As a matter of fact he was producing at the machine 5,000 tons, but the total tons of No. 1 ware drawn from his kilns was materially less. We consider the output at our plant as the tons of No. 1 ware wheeled from our kilns.

I might say that we would have no faith in a cost system that was not interwoven with our regular books of account. We keep an accurate distribution of our expenses and go into it quite thoroughly by carrying a ledger account for each sub-divided item of expense for each department. As an example, our pit expenses are divided into the following, each of which has its own ledger account: pit labor, pit fuel, pit repairs and pit supplies. The total expenses shown on our cost sheets as the total of these accounts is then figured against the production of the pit in tons of ware giving of course the cost per ton. So on through our entire plant each department has from four to one dozen accounts. The departments consist of pit, machine room, drying, transferring and setting, burning, and drawing. Next comes factory overhead, or as we term it "indirect." Our overhead expenses, separated as to selling, office and miscellaneous are sub-divided just as carefully as our factory manufacturing costs are. We not only arrive at cost figures monthly but by carrying cumulative totals of our distribution as figured against cumulative production totals we have an average cost figure that is an item that I would particularly like to call your attention to.

In an industry subject to as wide fluctuations as the heavy clay products

industry is, if each manufacturer arrived at his costs carefully on an average basis as mentioned, there would certainly be a far more satisfactory condition within the industry. These averages, or cumulative figures, can be taken over a period of six months or a year, or of course it would be an ideal condition if the trade would start in and keep their average costs over an indefinite period. I would like to add that I firmly believe that selling costs should be averaged over a like period and I earnestly advise the industry to compare their average selling costs with their average manufacturing costs.

I think this covers briefly our views as to cost accounting with particular attention called to (1) the advisability of careful counting of ware for our production records, (2) the fact that No. 1 ware only taken from our kilns is what we count as production from our plant, and (3) the importance that we advise the industry to attach to cumulative or average cost figures. Ample depletion and depreciation charges are made on our books of account and since our accounting system is a part of our cost system, depletion and depreciation are of course considered in our costs.

MR. STEVENS:—Do you include interest on the investment?

MR. DAILEY:—We do not include interest on the investment as a part of our cost expense.

MR. GREENOUGH:—What have you got to say about depreciation on plants operating at less than full capacity?

MR. DAILEY:—We charge that at the same rate as we would have charged had we been running full time.

MR. GREENOUGH:—Suppose you were only running 50%, would you charge the full amount?

MR. DAILEY:—We charge the full amount just the same. I have gone on the assumption that a plant depreciates just about as rapidly running on part time as it does running on full time, or at full capacity. Possibly a reasonable exception could be taken to this although I would have to be convinced. Running at 50% capacity as compared to full capacity would of course make a depletion charge for depletion of raw material just 50% of what it would be were we running at full capacity.

Most of our work throughout our plant is on a piece-work basis and once in a long while we find that either due to an error or wilfully, our records for the output of the department will be off. With close supervision, however, these are promptly detected and if we have a reasonable doubt as to its having been a wilful miscount we do not hesitate in adjusting the record, and in some cases this adjustment almost amounts to a penalty. I can assure you that after we make these adjustments it is several months, or close to a year before the same thing is repeated. In fact the labor gang has to change almost entirely. In our plant the employees in the different departments for the most part do their own tallying and counting. Stand-

ard loading of dryer cars for each size of ware is pretty closely adhered to. Holding that the setters in our case are entitled to pay for ware rejected, we believe that this course insures as careful inspection by the setters as it is possible for us to get.

This cost system has been working for years and the longer it is in use, it follows that the more valuable it becomes to you because of the information you have accumulated for comparison.

MR. CHILD:—Whenever we get into this subject of costs, I am reminded always of a little incident that happened in Pittsburgh a few years ago.

An old Irishman had built up quite a large business. He didn't know anything about costs, and very little about accounting. He was one of those drivers that had started with nothing and had gotten several boats under his control, running from Pittsburgh down the Ohio River.

One day after they had made quite an extensive trip, he said to his bookkeeper: "Well, how much did we make on this trip?" The bookkeeper said: "Well, I am sorry I haven't got my books closed yet. I haven't got my balances."

The old fellow stood and looked at him a minute and he said: "Got your bills all paid?" The bookkeeper said "Yes." Then the old fellow said: "How much money have you left?"

I often think of that when we get to talking about costs and the greatest fallacy in cost accounting is the fact that so many firms try to put in an accounting system without tying together their general cost and their manufacturing costs per ton or per thousand. Thus over a period of five or six months they might show a profit compared with their costs but be out of line with the net profits shown when they close their books. Often there has been a tremendous loss some place along the line that they haven't taken into consideration.

We ran along for about three years, trying to keep a very itemized cost account in which every employee had a time slip. The time slip was checked at night, showing the number of hours employed on each job. The hours for each job were charged against a certain account. We are now manufacturing drain and hollow tile in sizes from 3″ to 27″, inclusive. We take our total expense for the month, based on the sales journal, We do not take consideration of our No. 2 tile or cull tile; we figure that the No. 1 tile sold has to carry the load of our entire production. Therefore, if our records show that 2500 tons were manufactured in the month, and our inventories and sales show 2300 tons a month, we have lost some place in the operation 200 tons. Therefore, the 2300 tons a month must carry the full burden of all costs.

We have never worked out a satisfactory cost for each size of tile and I don't know of anybody else who has.

We all know that the loss on a four- or five-inch tile compared to the

loss of 27″ tile amounts from 25 to 35%, but I do not see how a tile plant can work on any other basis than by the ton.

I was very much interested a few days ago when I heard Mr. Wills, who was on the Federal Reserve Board of the Cleveland District, say that the next three years would probably be the most highly competitive that this country has ever experienced. I feel that this year the selling price will be quite largely determined by the other fellow, but your own cost price is determined by yourself and nobody else, and I think that during the next two or three years the men who make a success in the heavier lines of clay products will be the fellows who spend the major portion of their energy on reducing costs, rather than on sales. I have never seen a time in my life when it was a price market so much as it is today and I think it is going to continue that way for some time.

Mr. Dailey:—Our cost system is entirely tied up with our books of account. Each subdivision of our departments has a ledger account, and it is just as much a part of our books of account to furnish information for the cost system as it is for profit and loss. Whether you count your sales as output or not would be immaterial over a long run; it would average up over a year, but why make one month's profits suffer because you happen to store ware in the yard.

Mr. Amos:—It does not; your difference in your inventories takes care of that, Mr. Dailey. For example, if you make two thousand tons, and you sold 1500 tons for the month, the difference between your inventory the first of the preceding month, and the last of the month would add to that inventory to show that you had gained 500 tons for that month.

We keep a tabulated record of our machine production, a tabulated record of our kiln production, or what goes into the kiln, and a tabulated record of the good material that comes out of the kiln, but when we get down to our cost per ton, it is based on our sales record, because if you take the emptying record, or the drawing record, your stock on the yard would still show another loss that is not accounted for. Everybody has culls that come out of their stock, and if you base it on the sales, or what you actually receive from your sales, you take care of all these shrinkages.

Mr. Greenough:—In other words, you check your production records by deducting shipments from your inventories?

Mr. Amos:—Yes sir.

Mr. Stephens:—In regard to the difficulty of manufacturing both building brick and paving brick, I believe that from our own experience I might be able to say a word appropriate to that. There is as much difference on a tonnage basis, between paving brick and building brick as there is in our case between building brick and floor tile, and we find that it is the most satisfactory and not at all difficult to separate those items of operation which are distinctly different and keep those entirely separate.

For instance, our machining, setting, and drawing of the floor tile is kept entirely separate from the face brick, and the same thing in the case of the paving brick manufacturer. The paving block items should be kept entirely separate from those for the building brick. Then the general items of clay, fuel, power, drying and burning can be pro rated on a tonnage basis very properly, and the little additional effort required in keeping those special items of expense separate will be many times justified by the accurate results which can be obtained, and will not produce the confusion which a tonnage application would have, as for instance, a five pound builder and an eight, nine or ten pound paver, because there are so many items where the labor costs are so different.

Mr. Tefft:—I feel that you cannot go too deeply into finding out what the cost of each different operation of our brick manufacture actually is. You have got to know what your costs are from month to month, from year to year. If you don't know what each item costs, you cannot control them, and the man who sits in the office, or the man in charge of the plant who is not right on the ground, must make definite comparisons. Unless he has a good cost system he cannot do this.

REMARKS FOR DISCUSSION ON SILICA BRICK[1]

By K. Endell:—In regard to the observation of Mr. Greaves-Walker that Findlings quartzite is similar to some found in Illinois and in old material used as Indian weapons, I might remark that chalcedony must not be confused with Findlings quartzite. The characteristic of Findlings quartzite is that it consists partly of chalcedony and partly of coarse grains of quartz crystals inbedded in the chalcedony.

The decrease of Findlings quartzite in Germany is leading to the use in larger and larger quantities of German Silurian quartzite which, in part, is very similar to the Medina and Baraboo quartzite. Most firms at present add about 50% of such quartzite to the Findlings quartzite, while some add about 80%. Occasionally silica brick are made from only such quartzites.

It is worthy of note that, thanks to the special manner of preparation of silica brick from such Silurian quartzites, only cone 14 is used in burning. They usually have a specific gravity of 2.45–2.50. Indeed the steel industry figures on a suitable expansion and allows expansion joints for the later expansion of the bricks. In figuring expansion joints, one can only rely upon the fact that this specific gravity can be guaranteed. It is to be noted that at present no standard exists.

[1] Discussion, *Bulletin, Jour. Amer. Ceram. Soc.*, **1**, 180 (1922); K. Endell, **5**, 209 (1922).

The softening temperatures for silica brick given in my paper (*Jour. Amer. Ceram. Soc.*, 5, 216 (1922)), as determined in the Steger press, are too low. Before I went to America, I had only made a few determinations with this press and all sources of error, as in temperature measurements, were not sufficiently considered. Above 1450°C the carbon furnace gave off vapors which made the optical temperature measurements uncertain.

Careful experiments on the true softening temperature have shown that the values given are on the average about 100°C too low. I have run about 100 new determinations which gave 1520–1660°C as the softening temperature for standard silica brick. These values agree with those found in America and with some earlier values I had obtained.

Translated by E. N. Bunting

DISCUSSION[1] ON "THE EFFECT OF SOURCES OF PIG IRON UPON THE ENAMELING OF CAST IRON[2]

By E. P. Poste:—The enameling industry pays too little attention to the metal that is being enameled. The past two or three years have seen the beginnings of an appreciation of this fact and it is very promising to see records appearing in the literature and to know of researches being taken up by technical organizations.

With particular reference to the subject of cast iron as a material to be enameled, there are two phases of the matter which should receive consideration: namely, the composition and structure of the iron. By structure is meant the particular manner in which the constituents, more specifically the iron and carbon, enter into combination within the casting. Bearing on the latter point it must be realized that various types of iron undergo different structural changes during the enameling operation, without changes in composition as a whole.

Some enamelers claim that any kind of mechanically good gray iron can be successfully enameled. Others hold that certain definite specifications as to composition give best results. The writer has discussed this matter with a large number of enamelers and the notes available include the following ranges of composition as having been recommended for sanitary ware:

Sulphur	0.07	to	0.09	Silicon	2.20	to	3.00
Phosphorus	.70	to	.80	C. Carbon	.20	to	.40
Manganese	.30	to	.60	G. Carbon	3.00	to	3.30

Another interesting set of compositions has resulted from analysis of

[1] Received Oct. 11, 1922.

[2] M. E. Manson, *Jour. Amer. Ceram. Soc.*, 5, 806 (1922).

various European irons used in the manufacture of chemical apparatus. They range as follows:

Sulphur	0.05	to	0.10	Silicon	1.70	to	2.70
Phosphorus	.90	to	1.80	C. Carbon	.09	to	.20
Manganese	.30	to	.70	G. Carbon	2.90	to	3.65

The outstanding differences seem to be the higher phosphorus and the lower combined carbon in the foreign iron. The latter point may result from the fact that all the castings involved in the foreign analyses had been enameled, the enameling operation often causing a drop in the combined carbon.

With reference to the differences between southern and northern iron, the writer can offer no comment other than that his experience has been with northern iron entirely and that the type of troubles being studied by the author has not been encountered. The fact that harder, acid-resisting enamels are involved, as compared with the sanitary type, may have a bearing on this situation.

The author passes over slight differences in combined carbon as insignificant. When it is realized that this combined carbon is chemically united with iron as cementite weighing 15 times as much as the carbon involved, and that this cementite is in turn associated with ferrite to form pearlite 7.4 times as heavy as the cementite, it is seen that slight differences in combined carbon really mean quite radical differences in structural composition. As a specific case we will compare 0.10% and 0.30% combined carbon. In the former case there is 1.50% cementite and 11.1% pearlite; in the latter, 4.5% cementite and 33.3% pearlite. These structural compositions are on the basis of a well-annealed iron, a condition quite sure to follow enameling. For a thorough consideration of the various combinations of iron and carbon in cast iron the reader is referred to Chapter 6 of "Howe's Metallography of Steel and Cast Iron."

The author mentions the possibility of the formation of gases in the iron. The whole matter of the form of the graphite plates, penetration of gases, permanent growth of iron on heating and several related subjects cannot be overlooked in a thorough study of the problem. Hatfield in his book "Cast Iron in the Light of Recent Research," particularly in Chapter 10, records some very pertinent information which cannot be discussed here.

The author's micros of the various irons being studied are very interesting. There are two ways of observing the structure of iron. The use of unetched specimens reveals the nature of the graphite present while etching, as has been done in this case, brings out the other structural features, sometimes producing such a complex field that it is more difficult to note the general nature of the iron.

In researches on iron in connection with enameling the writer has encountered two types of blotches in iron. The first has been termed "nesting" of the graphite. It is best observed on an unetched specimen. This structure is not fundamentally changed on heating, as in enameling, unless the graphite plates originally present form the nuclei for the separation of more graphite from the cementite. The other type of blotches is revealed on the etching of certain irons. It is fundamentally a matter of structure other than free graphite. The annealing of the specimen results in the disappearance of the blotching and the production of a fairly uniform field.

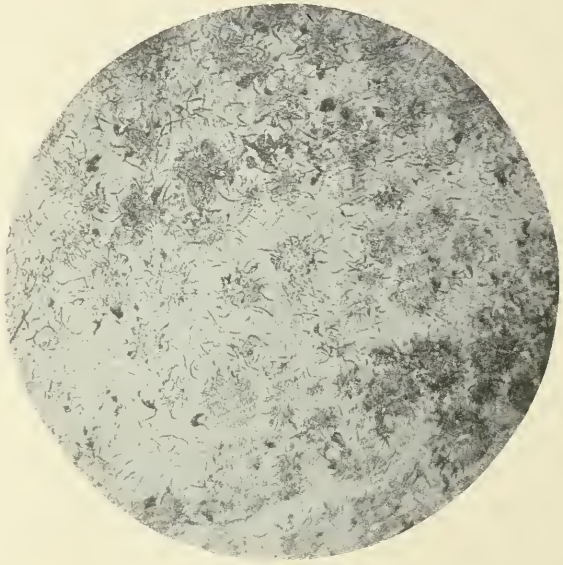

FIG. 1.

The first type of blotching is illustrated by micro No. 1 which is of an unetched specimen of the following iron:

Silicon	1.92	Manganese	0.59
Sulphur	.121	C. Carbon	.90
	Phosphorus 0.69		

This iron showed fundamentally the same structure after annealing.

The second type of blotching is shown in micro No. 2 which is from an etched specimen of the following iron:

Silicon	1.31	Phosphorus	0.39
Sulphur	.063	C. Carbon	.90
Manganese	1.18	G. Carbon	2.94

FIG. 2.

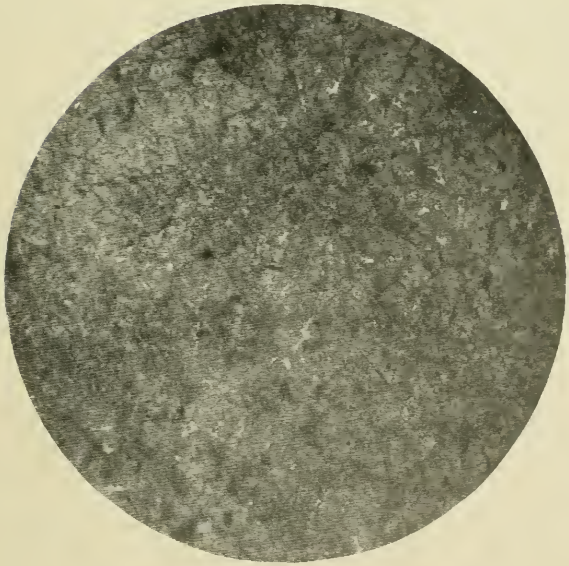

FIG. 3.

This iron after annealing is shown in micro No. 3. Apparently this metal structurally is very close to the eutectic matrix.

The writer is not at all sure that either type of blotching herein illustrated is related to the type presented by the author. But there is possibly a close resemblance between the author's Fig. 9 and the writer's micro No. 2.

If the blotches mentioned by the author are surface blotches, possibly resulting from reaction with the atmosphere through the ground coat, why is it that others do not appear after the surface has been removed by sandblasting exposing a fresh surface for the second enameling? Has the annealing incidental to the first enameling had a part in this?

The writer realizes that this discussion in no way furthers the knowledge of the matter under consideration. Perhaps it will help to bring certain new lines of thought to the problem as it seems to relate to the sanitary enameling industry.

By Homer F. Staley:—In connection with M. E. Manson's paper the following quotations from the "Metallurgy of Cast Iron" by Thos. D. West, 13th Edition, pages 246–7–8, may be of interest.

"An increase in the total carbon, with all other elements remaining fairly constant, increases the life or heat of molten metal, softens the iron, increases deflection and decreases its strength. Where high carbon exists it may cause a kish or scum to rise, which may often be the means of producing dirty or porous castings. Such results can often be remedied by lowering the carbon in mixtures, by the addition of low carbon pig metal or steels, etc."

"Allowing for changes in the percentage of total carbon, the combined carbon varies closely with those of silicon and sulphur, especially the former or, in other words, with a constant total carbon, sulphur, and manganese, etc., the higher the silicon, the lower the combined carbon and the higher the graphite, in normally made and cooled pig iron or castings."

"Very high carbon or silicon can cause metal to be sluggish or thick on the surface, at either the furnace or foundry. Such iron can often be seen evolving a great deal of kish at the furnace, or a scum at the foundry, and makes it very difficult, when in iron, to obtain clean castings.

"To obtain a thin or clean iron and one which will run quickly while it is hot, in making gray castings, use a mixture which will give castings having carbon 3.00 to 3.75, phosphorus .80 to 1.00, manganese .40 to .60, silicon 2.50 to 3.00; sulphur to be below .07. Such an iron, while running thin as long as it retains its heat, could be made softer and have longer life by increasing the carbon and silicon above the limits here shown, but by doing this the thinness, or quicksilver action, would be reduced unless phorphorus was increased, which would be liable to make the castings brittle. The higher the total carbon, the less silicon is required to maintain

the grade and the higher can the carbon be held in a combined or graphitic state, other conditions being equal."

In making castings for enameling, the writer has found the above specifications quite satisfactory with the exception that the silicon content should vary from 1.50 to 2.50. In general the lower the silicon can be kept with good foundry practice the better the enameling qualities of the iron.

Mr. Manson has done a nice piece of experimental work and has shown the practical way to overcome a difficulty that has been experienced by many enamelers. For this he deserves the gratitude of the whole cast-iron enameling industry. The above quotations are given simply to emphasize the possibility, recognized by Mr. Manson, that the trouble may be due to separation of carbon in irons with low combined carbon.

ACTIVITIES OF THE SOCIETY

THE EIGHTEEN HUNDRED MARK PASSED

The "Young Lady Across the Way" was told the other day that a set back helped a football team a lot, whereas she had always thought the players in the other positions were just as important.

This month the set back on the AMERICAN CERAMIC SOCIETY football team was just a little more prominent than any other position. A number of small gains were made but only one man really distinguished himself. This was W. C. Lindemann who bucked the Enamel line for ten yards and successfully completed two forward passes to Danielson. Sortwell and Ayars made good gains around east and west ends respectively, while Ortman, M. E. Gates, Davis Brown, and MacMichael had the ticklish end of four forward passes.

Hursh, Frost, Wenning, and Knollman gained ten yards each by line plunges. Riddle made a quick recovery of a fumble and carried the ball ten more. Dornbach, Howe, and Lambie, the refractory back field, broke through their opponents for ten yards apiece. Lord, Lyon, Rand, Cox and Wilkins filled their positions creditably and carried the ball at various times for ten yards.

The record of each man follows:

	Personal	Corporation		Personal	Corporation
W. C. Lindemann	1	2	F. H. Riddle	1	
E. E. Ayars	2		H. J. Knollman	1	
H. H. Sortwell	2		W. E. Dornbach	1	
P. S. MacMichael		1	R. M. Howe	1	
Davis Brown		1	J. M. Lambie	1	
F. B. Ortman		1	F. G. Lord	1	
M. E. Gates		1	J. B. Lyon	1	
R. K. Hursh	1		C. C. Rand	1	
L. J. Frost	1		P. E. Cox	1	
W. F. Wenning	1		W. W. Wilkins	1	
			Office	7	1

Total 25 Personal, 7 Corporation

The net increase for ten months of 1922 is:

	Personal	Corporation
Nov. 15, 1922	1593	218
Jan. 1, 1922	1350	139
Net increase	243	79

The gross increase by periods since June, 1921 is as follows:

	Personal	Corporation	Total
June to September, 1921	41	11	52
September to December	18	2	20
December to February	136	21	157
February to May	81	10	91
May	13	13	26
June	13	5	18
July	25	11	36
August	20	5	25

	Personal	Corporation	Total
September	31	11	42
October	31	12	43
November	25	7	32
Gross increase	434	108	542
Loss	82	5	87
Net increase	352	103	455

Not so many years ago an enthusiastic member of the SOCIETY was heard to say that he believed the SOCIETY could reach in time the dizzy height of 750 members. This remark was tolerated by the more conservative as youthful exuberance, gently but firmly to be suppressed.

On November 1, 1922, the mail brought into the office of the Secretary contained two personal and three corporation application cards, and the total membership was magically raised to more than 1800. Now probably some bold, young spirit will rashly declare that we shall have 3000 members in a few years. The very idea!

NEW MEMBERS RECEIVED FROM OCTOBER 16 TO NOVEMBER 15

ASSOCIATE

Alderson, Benjamin, Chemist, American Bottle Co., Streator, Ill.

Boeker, Victor W., 1111 W. Stoughton St., Urbana, Ill., Student.

Bowne, Martin S., 422 W. Locust St., Clearfield, Pa., Supt., Clearfield Sewer Pipe Co.

Bryson, Frank W., Charleston, W. Va., Supt., West Virginia Brick Co.

Davies, James A., 1727 Bryn Mawr Rd., Cleveland, Ohio, Enameling Foreman, Vitreous Enameling Co.

Dougherty, George C., P. O. Box 667, Reading, Pa., Supt., Reading Vitreous Enameling Works.

Gaardsmoe, H. L., 141 Industrial Bldg., Bureau of Standards, Washington, D. C., Research Fellow.

Keeler, R. B., 2298 E. 52nd St., Los Angeles, Cal., Pres., Southern California Clay Products Co.

Kennelley, Griffith S., 302 Union St., Joliet, Ill., Sales Representative, American Refractories Co.

Leonard, Philip C., 210 Iowa Ave., Joliet, Ill., Sales Representative, American Refractories Co.

Minnigerode, J. H., P. O. Box 935, Baltimore, Md., Foreman, American Refractories Co.

Morris, Bernard L., 50 S. 11th Ave., Coatesville, Pa., Midvale Steel and Ordnance Co.

Owen, W. G., Haws Refractories Co., Johnstown, Pa., Asst. Sales Manager.

Paxton, Elisha W., 118 Le Moyne Ave., Washington, Pa., Highland Glass Co.

Peck, J. Clair, 4961 Neosho St., St. Louis, Mo., Burn Despatcher, Laclede-Christy Clay Products Co.

Peters, M. F., 534 11th St. S. E., Washington, D. C., Associate Ceramic Engineer, Bureau of Standards.

Radcliffe, Louis C., Jr., 10500 Clifton Blvd., Cleveland, O., Salesman, Roessler & Hasslacher Chemical Co.

Rockwood, Nathan C., 542 S. Dearborn St., Chicago, Ill., Editor and Vice Pres., "Rock Products."

Scherer, Oscar, 940 McAllister Ave., Columbus, O.
Shedd, Solon, College Station, Pullman, Wash., Prof. of Geology and Head of the Dept. of Geology.
Straight, F. W., Auburn Brick & Tile Co., Gen. Mgr., Auburn, Sac Co., Iowa.
Thrower, Wm. John, Minerva, Ohio, Supt., Owen China Co.
Weidman, Frank A., 38 S. Dearborn St., Chicago, Ill., Special Representative, Inland Steel Co.
Welsford, Henry R., 2022 N. Broad St., Philadelphia, Pa., Research Laboratory, Abrasive Co., Bridesburg, Pa.
Wirick, Jean Paul, 2611 W. 62nd St., Chicago, Ill., Pottery Instructor, Technical High School.

CORPORATION

Clay Service Corp., 138 N. La Salle St., Chicago, Ill.
Elgin Butler Brick & Tile Co., Austin, Texas.
Hadfield-Penfield Steel Co., Bucyrus, Ohio.
Mansfield Sheet & Tin Plate Co., Mansfield, Ohio.
Northern Clay Co., Auburn, Washington.
Portsmouth Stove & Range Co., Portsmouth, Ohio.
Tropico Potteries, Inc., Glendale, Calif.

WHO'S WHERE IN THE AMERICAN CERAMIC SOCIETY?

Earl B. Baker, one of the crew of the U. S. Bureau of Mines Laboratory Car, has recently accepted a position with the Southern Clay Company, of Robbins, Tenn.

Daniel D. Berolzheimer, Assistant Technical Editor of the Chemical Catalog Co., Inc., notifies us that the offices of the company have been moved from One Madison Ave. to 334 Fourth Ave., New York City.

A. W. Bitting, Director of Research of the Glass Container Association of America, has moved from Chicago to 1912 Clinton Ave., Alameda, Cal.

Mrs. J. T. Bramlett is now living at 1698 Glenview Ave., Memphis, Tenn.

O. O. Bowman, 2nd has severed his connection with the Trenton Fire Clay and Porcelain Company and is giving all his time to the Bowman Coal Co. of which he is Secretary and Treasurer. His address is the Broad Street Bank Bldg., Trenton, N. J.

Robert Brewster, formerly of Chicago, has taken up his residence at 119th and 86th Sts., Palos Park, Ill.

Albert D. Busch, of the W. S. Tyler Co., has changed his address from Pershing Ave. to 4945 Spalding Ave., St. Louis, Mo.

C. V. Cameron, formerly of Richmond, Cal., is now with the Whiting-Mead Commercial Co., 2035 E. Vernon Ave., Los Angeles, Cal.

Rod. Castro Oliveira, who has been studying at the New York State School of Ceramics, Alfred, N. Y., for the past three years, is on his way home to Santiago, Chile, and is at present in England.

Dorothy Peck Chapman has moved from Greenfield, Mass., to 131 N. 19th St., East Orange, N. J.

A. L. Duval d'Adrian, formerly of Washington, Pa., is now located at Alton, Ill.

Leon E. Ells, who graduated from the New York State School of Ceramics last June, is with the Laclede-Christy Clay Products Co., St. Louis, Mo. His address is 4425 A Flad Ave.

T. W. Garve, of the Ceramic Supply & Construction Co., has changed his residence to 55 N. 20th St., Columbus, Ohio.

Wm. H. Grueby has recently changed his address from Perth Amboy, N. J., to 680 Madison Ave., New York City, where the Exhibition Rooms of the Grueby Faience & Tile Co. are situated.

Herman A. Hall, who is with the Medina Clay Products Co., Medina, Ohio, recently called at the office of the Secretary and denied the rumor that he had been "lost."

Fred T. Heath, of the Heath Unit Tile Co., has been transferred from Seattle, to Tacoma, Wash., where his address is the Puget Sound Bank Bldg.

Joseph W. Hoehl has moved from Piqua, Ohio, to Detroit, Mich., where he is with the Wolverine Porcelain Enamel Co.

W. W. Ittner, Treasurer of the General Clay Products Corp., St. Louis, Mo., gives as his new home address 5141 Waterman Ave.

Walter A. King, of the Elyria Enameled Products Co., is now living at 149 Branston Ave., Elyria, Ohio.

Charles Laird, formerly of St. Louis, is now affiliated with the Southern Clay Mfg. Co., North Birmingham, Ala.

J. S. Laird has moved from Charleston, W. Va., to Imlay City, Mich.

A. Malinovszky is with the Washington Iron Works, Los Angeles, Cal.

C. R. Minton, who graduated from the Ceramic Department of Ohio State University last June, has accepted a position with the Los Angeles Pressed Brick Co., Los Angeles, Cal.

J. A. Nagle, of the Pittsburgh American China Co., has gone from Columbus, Ohio, to live at 315 Center Ave., Greensburgh, Pa.

Fred H. Schwetye, of the Laclede-Christy Clay Products Co., has changed his address from Manchester Ave., to 5445 Queens Ave., St. Louis, Mo.

B. T. Sweely, formerly with the Coonley Mfg. Co., Cicero, Ill., has recently accepted a position with the Cribben & Sexton Co., Chicago, Ill.

A. J. Walcott, who last month appeared among the "lost," has notified the office that he is doing graduate work in the Department of Geology at Northwestern University, Evanston, Ill.

R. H. White, of the Norton Co., is now living at 617 Buffalo Ave., Niagara Falls, N. Y.

C. L. Wigfield, of the Elyria Enameled Products Co., has moved from W. Broad St. to 438 Cleveland St., Elyria, Ohio.

NO ADDRESSES

The list of unknown addresses remains about the same. Some are located each month, but a few others are A.W.O.L. Information will be gratefully received by the Secretary.

Baker, G. V., Penn Feldspar Co., Philadelphia, Pa.
Bickel, Earl A., Postville Clay Products Co., Postville, Iowa.
Brett, R. C., Southern Clay Mfg. Co., North Birmingham, Ala.
Callaghan, J. P., c/o Teaque Hotel, Montgomery, Ala.
Dolley, Charles S., Keramoid Mfg. Co., Fort Madison, Iowa.
Greenwood, John L., Lehigh Sewer Pipe and Tile Co., Lehigh, Iowa.
Groocock, Alice, 865 Bathurst St., Toronto, Ont.
Kitamura, Y., Shofu Kogo Kafushiki Kaisha, Kyoto, Japan.
Knote, J. M., Mines Dept., Sault Ste. Marie, Ont.
Lodwick, J. A., American Arch Co., 17 East 42nd St., New York City.

Mitchell, Leon W., Rock Island Stove Co., Rock Island, Ill.
Morrow, Robert P., Harbison-Walker Refractories Co., 1513 Rockefeller Bldg. Cleveland, Ohio.
Okura, K., 84 Kobayashi-Cho, Nagoya, Japan.
Pendrup, W., Coonley Mfg. Co., Cicero, Ill.
Pulsifer, H. M., Geo. H. Holb & Co., Chicago, Ill.
Ragland, N. A., Alberhill Clay and Coal Co., Los Angeles, Cal.
Reid, W. H., 10 Stanley Place, Yonkers, N. Y.
Stewart, John G., 530 Union Trust Bldg., Cincinnati, Ohio.
Van Moore, A. L., American Photo Glass & Export Co., New Eagle, Pa.
Vodick, William J., 1733 Lake Ave., Wilmette, Ill.
Yamamoto, Tamesburo, Yamatame Glass Mfg. Co., Osaka, Japan.

AN EXTRA INDUCEMENT

It has been voted by the Board of Trustees to allow new members now to join the Society for 1923 and to purchase the *Journal* for 1922 at member's rate, if they desire.

Persons who wish to take advantage of this offer will therefore pay

Dues for 1923	$7.50
Journal for 1922 at member's rate	4.80
	$12.30

and obtain the principal privileges of membership for two years at a saving of $2.70.

Members are urged to use this argument in connection with their invitations to others to join the Society.

ASK THAT MAN TO JOIN

There are many who would join the Society when the opportunity is presented. Here is a letter typical of several we have received:

> "Mr. S. F. Walton of the Northern Refractories Co. has advised me that I can join your Society. I am greatly interested in the Refractories Division and, if agreeable, will you kindly send application blank and bill for dues."

ADVANCE NOTICE SECOND ANNUAL CERAMIC EXHIBITION

Twenty-Fifth Annual Convention American Ceramic Society

James C. Boudreau, Director of Art Education, 725 Fulton Bldg., Pittsburgh, is Chairman of the Committee on Exhibition

In planning for the second Ceramic Exhibition to be held during the coming Convention in February, it is obvious that this should be in harmony with the occasion of the celebration of the Twenty-Fifth Anniversary of the founding of the American Ceramic Society.

Not only should the present ceramic field be adequately represented, but where possible, examples showing the development during the past twenty-five years should be included.

No one will question the accomplishments in American ceramics during this comparatively short space of time. No other country can show such technical and practical development within such a short period. But unfortunately, there have been few opportunities to show collectively the various types of ceramic work together with examples showing developments covering a period of years.

The Exhibition last year was the first attempt to do this, and the result was successful enough to make the Exhibit an annual event.

Members of the Society are urged to coöperate in making this Exhibition a distinctive event.

Members having examples of early American pottery and glass are asked to loan these during the period of the Exhibit.

Every care will be taken of the exhibits, and expert packers will be engaged to pack for return shipment.

The various exhibits will be classified as follows:

A. Utilitarian White Ware
B. Electrical Porcelain
C. Chemical Porcelain
D. Sanitary Ware
E. Terra Cotta
F. Building Brick and Tile
G. Floor and Wall Tile
H. Faience
I. Art Pottery
J. Chemical Stoneware
K. Utilitarian Stoneware
L. Sewer Pipe
M. Enameled Ware
N. Glass
O. Refractories
P. High School Pottery
Q. Universities and Bureaus

The Universities and Bureaus are urged to exhibit examples and methods of research.

Exhibition blanks and shipping tags will be sent out at a later date.

The Exhibition Committee Personnel:

Chairman: James C. Boudreau
White Ware: Lawrence Brown
Heavy Clay Products: C. Forrest Tefft
Glass: J. C. Hostetter
Refractories: R. F. Ferguson
Enamel: B. T. Sweely
Art: F. H. Rhead
Terra Cotta: R. L. Clare

CHICAGO LOCAL SECTION

A letter to the members of the Chicago Section of the American Ceramic Society has been issued by the Chairman, F. L. Steinhoff, calling the sixth annual meeting for Saturday, December 2. The program committee is putting forth special efforts to secure excellent papers and speakers for the occasion, and a large attendance is anticipated.

INQUIRIES FOR TECHNICAL INFORMATION RECEIVED FROM READERS DURING OCTOBER

The following questions pertaining to ceramic problems have been received by the Secretary of the SOCIETY recently. These problems presented are typical of the many which come in every month. Members who are interested in discussing these questions may send their discussions to the Editor's office (Lord Hall, O. S. U., Columbus, O.) where they will be edited and published.

(1) A chemical engineer wishes advice regarding refractories to withstand about 3600°F generated by an oil burner. Fire brick readily melts.

(2) Please advise where I can get a formula for engobe coating for use under glaze on solid porcelain material.

(3) I am in the stoneware and flower pot business and am especially interested in glazes for stoneware bodies. If the CERAMIC SOCIETY has anything on this subject would be pleased to receive same.

(4) Would you please advise as to the materials used, and their proportions, for white vitreous floor tile.

(5) We have used several different formulas for brown glazes for insulators each showing a variation in color in burning. Could you suggest a formula of a glaze that would be more stable in color?

(6) Would you be good enough to give us a list of glass sand manufacturers?

(7) We have, from time to time, been purchasing fused silica scrap in quantities of a few hundred pounds. Our requirements have increased so that in the future our purchases will be lots of several tons. Can you tell us how it is produced and whether it is a commercial product? Can you tell us which manufacturers or class of manufacturers would be most likely to be in position to supply us?

(8) Do you know of a book entitled "Laws and Rules of Clay Mining?"

(9) Can you give us a comparison of the melting points of German and Orton cones?

(10) I am anxious to get what data I can on the cost of handling different clay materials in the factory. I am naturally more interested in tiles than anything else, but articles on the costs and the best way of handling, not only tiles, but terra cotta or porcelain of any kind, would help me. I do not know if you have any articles of this kind, but if you have, I wish you would kindly send them to me with a bill for the same.

PUBLICATIONS OF THE AMERICAN CERAMIC SOCIETY

Single Volumes of the *Transactions* and *Journal* and separate numbers of the *Journal* may be obtained through the office of the Secretary. Members are allowed 40% discount from list for all Volumes of the *Transactions* and for all other than the current numbers of the *Journal*. The list prices are as follows:

	Transactions		
Vol. I	1899	110 pages	$4.75
Vol. II	1900	278 pages	in complete set only
Vol. III	1901	238 pages	$4.75
Vol. IV	1902	300 pages	$5.50
Vol. V	1903	420 pages	out of print
Vol. VI	1904	278 pages	$6.50
Vol. VII	1905	454 pages	$6.50
Vol. VIII	1906	411 pages	$6.50
Vol. IX	1907	808 pages	out of print

	Transactions		
Vol. X	1908	582 pages	in complete set only
Vol. XI	1909	632 pages	$6.50
Vol. XII	1910	882 pages	out of print
Vol. XIII	1911	837 pages	$6.50
Vol. XIV	1912	888 pages	in complete set only
Vol. XV	1913	747 pages	$8.00
Vol. XVI	1914	611 pages	$8.00
Vol. XVII	1915	815 pages	$8.00
Vol. XVIII	1916	947 pages	$8.00
Vol. XIX	1917	707 pages	out of print

	Journal			Single Nos.
Vol. I	1918	892 pages	$6.00	60c.
Vol. II	1919	1030 pages	$6.00	60c.
Vol. III	1920	1016 pages	$6.00	60c.
Vol. IV	1921	1050 pages	$8.00	75c.
Vol. V	1922	1671 pages	$8.00	75c.

A complete set of the *Transactions*, minus Vols. V, IX, XII, and XIX which are out of print, may be purchased at.....$150.00.

(Second-hand copies of Vols. V, IX, XII and XIX are sometimes available. Orders for these should be filed with the Secretary.)

To members of the SOCIETY a reduction of 40% will be made from the above prices. Members cannot purchase more than one copy of each volume at members' rate.

The SOCIETY has also published the following books, which will be sold net, at the prices listed, to the public and members alike:

"The Collected Writings of Dr. Hermann August Seger," Vol. I, (*a*) Treatises of a General Scientific Nature. (*b*) Essays and Refractory Wares. 552 pages. Bound in cloth..... $7.50

"The Collected Writings of Dr. Hermann August Seger," Vol. II, (*a*) Essays on White Ware and Porcelain. (*b*) Travels, Letters and Polemics. (*c*) Uncompleted works and extracts from the archives of the Royal Factory. 605 pages. Bound in cloth..... $7.50

"A Bibliography of Clays and the Ceramic Arts," by Dr. John C. Branner, 1906. 451 pages. Bound in cloth. Contains 6027 titles of works on Ceramic subjects..... $2.00

"Collective Index to the *Transactions of the American Ceramic Society*," compiled by E. J. Crane..... $1.50

ELECTRIC FURNACE FOR GLASS MANUFACTURING

An Inquiry from Dr. M. E. Holmes, Acting Secretary and General Manager of National Lime Association

During the past months I have been in correspondence with a number of people on the subject of furnaces for glass making. As is well known the ordinary glass tank furnace is notoriously inefficient; only about 10% of the heat is utilized. The question has arisen regarding the utility of an electric furnace which of course might be insulated in such a way as to make the heating efficiency very much higher. In these days of fuel shortage it seems especially important to call the attention of the AMERICAN CERAMIC SOCIETY to this fundamental problem.

If there is any way in which interest in this matter could be stimulated so as to initiate research work on a commercial scale, it seems as if it would be well worth while. I would appreciate very much if you could see your way clear to lay this matter before one of your Committees or refer the matter to Dr. Tillotson, or give it your personal attention. I am informed by one of the electric companies that they believe there are important possibilities in the development of an electric furnace for glass manufacture. If such a project should be successful it would tend of course to concentrate the glass industry at Niagara Falls, but I can see no serious objection to that.

A MESSAGE FROM THE CHAIRMAN OF THE RESEARCH COMMITTEE

By Wm. M. Clark

Referring to your letter regarding featuring research work and encouragement of research by the Society in the December issue, I have been trying to think of some constructive suggestions.

One activity it might be well for the Society to consider is the establishment of some prizes or medals to be annually awarded for research work to students in colleges, technical schools and even high schools, resulting in essays or theses to be published in the *Journal*. Some of the technical societies have considerable funds for this purpose. Perhaps the American Ceramic Society has only limited funds, but even an appropriation of $100 or $200 to be divided up into a series of prizes might serve as a starter and some gifts might result later. For example this society might have an Orton medal similar to the Nichols and Grasselli medals, etc. Would suggest grading the prizes and making the minor grades a paid up membership in the Society.

Then again we should give a broad definition to the term "Research" and not make it appear too much of a pure science nature, for instance some such definition as "Keeping One's Eyes Open." Following out this thought we should ask manufacturers and ceramists in general to be observing, noting peculiar results, crystals, fusions, corrosion effects, freakish products, unusual troubles, remarkable results and to save samples and note conditions that produced such effects. Next if the interest of the schools where thesis work is carried on can be excited and they can be told that such and such problems exist and that samples may be obtained from Mr. Blank, we may make some progress in bringing the man who has a problem and the man who can help solve it together.

Each problem should first be brought to the attention of the chairman of the Research Committee of the Division, representing the industry to which the problem or observation belongs.

COMPARISON OF JOURNALS

	1921	1922
Original Papers in Journal Section	74	103
Original Papers with Discussions	5	20
Number of Abstracts	765	1530
Original Papers in Bulletin	No Bulletin	15
Discussions in Bulletin	No Bulletin	44
Pages	1050	
Original Section		944
Abstracts		340
Bulletin		387
Total pages	1050	1671

An increase in size of type page from:

$4'' \times 6\ 1/4''$ to $4\ 1/2'' \times 7\ 1/4''$

makes an increase of about 26% more space filled on each page. This larger type page first appeared in May, 1922.

NOTES AND NEWS

REPORTS FROM THE CERAMIC ENGINEERING DEPARTMENTS OF OUR UNIVERSITIES

The Ohio State University

The enrollment for the current year is as follows:

Sophomores	22
Juniors	10
Seniors	12
Graduate Students	4

The freshmen have not indicated their choice of courses so that the enrollment can only be estimated.

The equipment of the Department has been increased during the past year by the addition of a gas and oil fired muffle kiln with inside dimensions $2'\ 0'' \times 2'\ 0'' \times 2'\ 6''$ (for the study of terra cotta). Recording and indicating pyrometers from The Brown Instrument Co. and The Bristol Co., have also been received, which add greatly to the laboratory equipment. The Maxon Furnace & Engineering Co. have furnished a No. 1 Maxon Burner, thus improving the furnace equipment.

The change in the teaching schedules from two semesters to three quarters will increase the efficiency by permitting more concentration in the different courses, fewer subjects being studied at any given time.

The graduates of the Class of 1922 are located as follows:

E. R. Curry, Gladding McBean & Co., Lincoln, Calif.
A. L. Donnenwirth, Jeffery-Dewitt Insulator Co., Kenova, W. Va.
H. E. Ebright, The Ferro-Enameling Co., Cleveland, O.
R. E. Hanna, Atlantic Terra Cotta Co., Perth Amboy, N. J.
R. S. Kane, Jeffrey Mfg. Co., Columbus, O.
P. W. Lee, Heinz Roofing Tile Co., Denver, Colo.
C. R. Minton, Los Angeles Pressed Brick Co., Los Angeles, Calif.
D. M. McCann, The Sterling Grinding Wheel Co., Tiffin, O.
Burnette Purcell, National Fire Proofing Co., Aultman, O.
Willard Stief, Mount Clemens Pottery Co., Mount Clemens, Mich.
B. E. Whitesell, Kier Fire Brick Co., Salina, Pa.

The Student Branch of the American Ceramic Society was regularly organized for the 1922–1923 school year on October 24. The following officers were elected:

Chairman, C. A. Smith,
Vice Chairman, Edward Burkhalter,
Sec.-Treas., A. B. DeVol.

Meetings will be held on the first Tuesday night of each month and talks by prominent ceramic men will be given.

At each meeting a member of the senior class makes a short talk reporting on some practical ceramic experience gained through summer work.

New York State School of Ceramics

The registration figures at Alfred show the present student body distributed as follows:

	Men	Women	Total
Graduate Student	1	0	1
Seniors	10	2	12
Juniors	20	7	27
Sophomores	20	11	31
Freshmen	18	7	25
	69	27	96

This number is eight less than last year when an exceptionally large freshman class entered, still shown in the number of sophomores.

The staff of the engineering department has undergone no changes but in the Applied Art department Miss Erna Sonne, a graduate of the Rhode Island School of Design and recently Assistant Supervisor of Art in Syracuse, has taken the place of Miss Nelson, former Associate Professor of Design, who is now teaching in the Toledo Art Museum School.

On account of the large number of lower class men in the laboratories, adjustments have been made whereby the former furnace room has been converted into a Senior laboratory, and the furnaces have been assembled in the few vacant places left in the kiln house. On account of the lack of funds no important changes of equipment have been possible. The force of instructors is increasingly pressed for time and laboratory space for classes, and it is hoped that the efforts continually being put forth for increased appropriation may soon show results.

Graduates of last June are placed as follows:

Robert H. Armstrong, Fiske & Co., Watsontown, Pa.
Donald Bassett, National Fireproofing Co , N. Canton, Ohio
Robert Boyd, Sinclair Oil Co., Wellsville, N. Y.
Robert Clark, 560 Elmwood Ave., Providence, R. I.
Leon B. Coffin, Onondaga Pottery Co., Syracuse, N. Y.
Max D. Compton, Los Angeles Pressed Brick Co., Los Angeles, Cal.
Leon E. Ells, Laclede-Christy Clay Products Co., St. Louis, Mo.
J. Clair Peck, Laclede-Christy Clay Products Co., St. Louis, Mo.
Thomas C. Walker, Mosaic Tile Co., Matawan, N. J.
Alfred Whitford, Fiske & Co., Watsontown, Pa.

The Student Branch of the American Ceramic Society has begun its work and officers for the year have been elected as follows:

President, John McMahon
Sec.-Treas., Harold Rogers
Councilor, J. B. Shaw

University of Illinois

The new school year has opened with an attendance of 77 undergraduates, distributed as follows:

Seniors	18	Sophomores	22
Juniors	18	Freshmen	19
Graduate Students	3		

Besides these students registered in the course, there are several students coming from other departments in some of the classes.

The Department staff has undergone quite a change during the past summer. Dr. E. W. Washburn, former head of the Department has resigned and is now in Washington as Editor of Critical Tables which are being published by the National Research Council.

G. R. Shelton, Corning Glass Works Fellow, who has been working in the Department for some time on glass research problems completed the requirements for his doctor's degree in June. He is now a member of the staff of the Department of Chemistry of the University of Saskatchewan.

E. E. Libman who has been connected with the Department as instructor since 1918 received his doctor's degree in June and has been transferred to the Mathematics Department, where he is now an instructor.

Roger Doyle, laboratory attendant, after being with this Department for a few months has withdrawn to enter industrial work.

T. N. McVay, a graduate of this Department in 1914, and since employed in various plants engaged in the manufacture of clay products, has joined the staff as instructor.

It is expected that another instructor will shortly join the staff.

The Department has been quite fortunate in being able to add several important items to its equipment. We have purchased and installed a No. 328 auger brick machine with a side cut-lubricating brick die, one 5″ x 8″ hollow block die, one 4″ drain tile and one 8″ drain tile die, together with other items which especially adapt this machine for class instruction. This machine was purchased from the Hadfield-Penfield Steel Company of Bucyrus, Ohio.

Also, we have increased our pottery equipment by three standard jiggers and three standard pulldowns purchased from the Crossley Machine Company, one revelation pottery kiln made by the H. J. Caulkins Company, and a wall indicator with twelve point switch box furnished by the Charles Engelhard Company for use with the various furnaces and kilns.

The course in Ceramic Chemistry which was formerly known as the course in Ceramics is now in operation. This course is designed for the special training of ceramic chemists and differs from the course in ceramic engineering by the substitution of a larger amount of chemistry for engineering topics. Some years ago before the Department was transferred to the Engineering College a similar course was provided which, according to our recollection, was done at the instance of Ross C. Purdy who was in charge of the work at that time. This course seems to be attracting gratifying attention on the part of students who are looking forward to doing work of a purely chemical nature.

Our senior students will leave in charge of Professor Hursh on the annual inspection trip October 26, going to St. Louis where they will visit the following plants:

Laclede-Christy Fire Brick Company; Evens and Howard Fire Brick Company; Hydraulic-Press Brick Company; Mississippi Glass Company; Alton (Illinois) Paving Brick Company; Illinois Glass Company, Alton, Illinois.

Graduates of last June are scattered widely.

R. E. Arnold—Westinghouse Electric and Mfg. Co., Pittsburgh, Pa.

D. B. Atwell—Evens and Howard Fire Brick Company, St. Louis, Mo.

I. B. Branham—Batchelder Wilson Tile Co., San Diego, California.

H. T. Coss—on the staff of the Department of Ceramics at Rutgers College, New Brunswick, N. J.

J. R. Green—North Iowa Brick and Tile Company, Mason City, Iowa.

J. Lathrop—Tropico Potteries Company, Glendale, California.

R. E. Lowrance—Matawan Tile Company, Matawan, N. J.

Student Societies

The Student Section of the American Ceramic Society held its first meeting on Thursday, October 12. The officers for the current year are:

O. S. Mundy, Chairman
S. Q. Lee, Secretary-Treasurer.

The officers of the *Keramos* fraternity are:

H. G. Wolfram, President
S. O. Neiswanger, Vice-President
P. F. Larson, Secretary
H. T. Leverenz, Sergeant-at-Arms.

Iowa State College

The Ceramic Department of Iowa State College has 11 students in course distributed as follows: two Freshmen, four Sophomores, four Juniors, and one Senior.

To the faculty has been added this year Miss Ethel J. Bouffleur, University of Washington, who will teach pottery decoration and handmade pottery.

A steel-jacketed kiln with removable crown and with three fire boxes, all designed to make possible the use of any sort of fuel, to make heat balance computations easily, and to carry on any ordinary ceramic firing process under approximately commercial conditions, has been built by student labor from designs by Professor Cox. Parts are at hand for the building of a test furnace for refractories after the drawings and descriptions in the October, 1922, issue of the *Journal* as presented by Professor Moulton. Since nothing but a portable kiln has been in the Department for some years these two kilns help greatly.

In ceramic engineering no new courses or changes have been made. It has been decided to manufacture pottery in a limited way to demonstrate the use of Iowa clays and shales in finer wares than are now made and to satisfy requests that make this plan advisable.

Wayne E. Barrett, who graduated last year, is located with the Adel Clay Products Co., Adel, Iowa. Leslie R. Alt, who would have finished this year, has elected to spend a year in putting into running condition a plant that belongs to the firm of which his father is general superintendent. He will return for his degree later.

The Student Branch of the American Ceramic Society at Ames is the required Seminar. It meets weekly at the day and hour set into the college calendar. The program is made up by a student member, the same man serving throughout the year. Faculty men from all over the campus are invited to talk on matters of interest to the ceramist, from choice of electives to how the physical chemist will help the ceramist, and each member talks once during the year on some subject that pleases him. Frequent use is made of the excellent visual instruction service available at Ames. Bruce F. Wagner, President, Robert C. Boyd, Secretary, and Benjamin W. Willson, Treasurer.

Frequent meetings are held in addition to the regular meetings as the Department is active in all college affairs and finds time to match showings with the more robust departments of Iowa State College.

Rutgers College

The number of ceramic students at Rutgers College and the State University of New Jersey is steadily increasing and on Registration Day, September 19th, the total enrollment was 28, classified as follows:

2 Seniors	8 Sophomores
8 Juniors	10 Freshmen.

Two new instructors, namely C. C. Clarke, B.Sc. (Colgate), M.Sc. (Rutgers) and H. T. Coss, B.Sc. (Illinois), have been added to the teaching staff.

Practically all of the machinery and equipment has been installed at the new building and laboratory work is progressing at a rapid stride.

The student organization, the Rutgers Ceramic Club, held its first meeting on October 19th in the lecture room of the new building. Following the business meeting and election of officers, a very interesting and instructive talk on Enameled Brick was given by Mr. Chas. E. Jacquart of the American Enameled Brick and Tile Co., South River, N. J. Mr. R. H. Minton and Professor G. H. Brown are the Councilors of the Club.

A TEN WEEKS' COURSE

Professor Hewitt Wilson who will have charge of the ceramic courses given at the College of Mines, University of Washington, sends the following notice which is being distributed for the purpose of advertising this course. Readers of the *Journal* will be interested in reading the variety of subjects given especially in the ceramic department.

27th Annual Winter Mining Session

COLLEGE OF MINES, UNIVERSITY OF WASHINGTON, SEATTLE
JANUARY 4–MARCH 21, 1923

QUARTZ MINING

Ore Mining Methods	Ore Milling	Geology and Mineralogy
Drilling and Blasting	Mining Law	Principles of Chemistry
Forge and Foundry Practice	Mine Surveying	Fire Assaying (Gold-Silver)

PLACER MINING

Dredging for Gold	Hydraulics	Electric Blast Firing
Testing Placer Ground	Boring Methods	Melting and Refining Gold

COAL MINING

Mine Rescue, First-Aid	Analysis of Coals	Coal Washing Methods

CERAMICS

Clay Testing	Stoneware	Glaze Studies
Lime, Plaster, Cement	Whiteware	Clay Technology
Common and Face Brick	Refractories	Terra Cotta Manufacture

Expenses Consist of Laboratory Deposits for Material Actually Used and University Fee of $20.00. Thorough Equipment Is Available for All the Above Courses. No Previous Training is Required for Entrance. Anyone Who Can Read and Write English May Enroll.

A Postal Card to the College of Mines, Seattle, Will Bring Full Details Regarding this Session and the Regular University Courses.

GLASS EXPERTS WANTED BY TARIFF COMMISSION

Under the extended duties of the Tariff Commission in the Tariff Act of 1922 an increase of its technical staff is now under consideration.

Three or four men may be selected for schedule, two of which embrace the ceramic industries, and candidates qualified in glass will receive the first consideration.

The duties of appointees consist in collecting and assembling costs of production, prices of wares, marketing conditions, foreign and domestic, in brief, all the factors

that enter into the question of competition between materials and wares of domestic and foreign production.

Technical training is essential in order to enable the appointee to understand and analyze manufacturing principles, conditions and difficulties. But a knowledge of wares from the point of view of the buying public, that is to say, for utility and attractiveness, is no less needed.

UNITED STATES TARIFF COMMISSION
John F. Bethune
8th and E Street, N. W.
Washington, D. C.

RESEARCH—A CONSTRUCTIVE TRADE ASSOCIATION ACTIVITY[1]

A Message from the U. S. Chamber of Commerce

The value of scientific research, both from an economic and an industrial standpoint, has never been so fully appreciated as at the present time. The problems of the recent war forced science and its research activities to the front in all the civilized countries of the world. It is now realized by leading manufacturers that scientific investigation is a necessary adjunct to efficient operation. A utilization of the scientific knowledge now available, and a sympathetic coöperation in the free interchange of such information will lead to the adoption of improved manufacturing processes and do much to obviate the dangers of ignorant, destructive competition. The realization of this fact is shown by the 500 or more firms now maintaining laboratories for industrial research.

If there were no correlation of effort on research work, much duplication might result. The logical solution, therefore, is to have the trade association make this correlation. This enables a pooling of resources to maintain a central laboratory to render service to a larger group than is possible with only individual laboratories. Another and very important factor, especially valuable in strengthening trade associations, is that such centralized research work makes it possible for the small manufacturer, financially unable to support an individual laboratory, to profit from the investigations carried on.

TRADE ASSOCIATIONS CONDUCTING RESEARCH

It is not surprising, therefore, that a continually increasing number of trade associations are realizing the value of research as one of their most constructive activities. Of the 65 to 70 associations now engaged in this work to whom recent inquiry was sent by the Fabricated Production Department, 33 gave specific replies, indicating that 8 were conducting their research independently and 25 were acting in coöperation with some other agency. The general leaning is toward the scientific aspect of research work, as 19 are engaged exclusively in that class, 3 on general problems and 11 give attention to both types of problems.

In classifying the nature of association research work, the terms scientific and general have been used with the following meanings:

Scientific: When it relates to the chemical, physical, bacteriological or purely technical problems of an industry.

General: When it relates to the mechanical methods used in production, distribution, etc., and the study of non-technical and non-scientific problems of the trade.

An enumeration of the wide range of problems these associations are working on is not possible in a brief bulletin such as this.

[1] *Bulletin* issued by Fabricated Production Department, Chamber of Commerce of the U. S. A., E. W. McCullough, Mgr.

Coöperating Agencies

In the same manner that coöperation of manufacturers through their association prevents duplication, so does the coöperation of associations likewise prevent unnecessary waste of effort. There are a large number of technical and scientific agencies, both governmental and private, which welcome the active participation of trade associations in their research efforts. Only a few typical cases can be mentioned here, such as Forest Products Laboratory, Mellon Institute of Industrial Research, Bureau of Mines, Bureau of Standards, University of Illinois Engineering Experiment Station, Institute of Industrial Research and National Research Council. These are but a few of the 35 agencies which we know are already working on these problems, and there are, doubtless, a good many others, both public and private, which have been engaged in research for a number of years.

The Cost of Research

Probably few fields of association activity will produce greater ultimate returns than research. The Director of the Mellon Institute of Industrial Research is authority for the statement that "some one has estimated that one-half billion dollars is being saved annually through research for industry in the United States alone. It is not surprising to learn, therefore, that about $35,000,000 is being spent annually by American manufacturers in the conduct of laboratory research. No doubt, a like amount is expended in experimental and development work in the plants, that is, beyond the laboratory stage."

No specific statement of the cost of this work can be made as it varies according to the kind and amount of the work undertaken. Associations reporting to us give as their appropriation amounts varying from a few hundred dollars up to over $100,000 annually. Whatever the amount may be there is no doubt but that it is amply repaid in benefits secured.

Conclusion

The Fabricated Production Department is convinced that scientific research is an extremely important activity in which trade associations may engage legally and with great benefit to their members and the public generally. We stand ready to assist those associations desiring to undertake this work and the resources of the department are available to all those who wish to make use of them. We invite an expression of your opinion and an opportunity to serve you.

WHITEWARE STUDY IN PACIFIC NORTHWEST UNDERTAKEN BY THE U. S. BUREAU OF MINES

In the investigation of the white clays of the Pacific Northwest being made by the Seattle, Washington, experiment station of the Bureau of Mines, samples of kaolin were recently taken at Freeman and Mica, Washington, and at Joel and Troy, Idaho. The kaolins sampled will also be used in the refractory studies, in the hope that the quality of the fire brick from the companies operating in the district can be improved. The residual deposits of clay are more difficult to operate because of the lack of uniformity and the large quantity of decomposed schist and sand which are often in excess of the softened granitic material. Those deposits which have been at least partially water-sorted show more uniformity and greater concentrated quantities of white-burning clays. Several hundred pounds of feldspar were obtained from the old mica mines three miles north of Avon, Idaho. Heretofore, the feldspar has been thrown on the dump.

ENGINEERING FOUNDATION ELECTS A. D. FLINN TO NEWLY CREATED POST OF MANAGER

Election of Alfred D. Flinn as director of the Engineering Foundation, which is fostering organized industrial research on a nationwide scale, is announced by Charles F. Rand, chairman of the Foundation. Mr. Flinn is the first incumbent of the new post, created by the Foundation's governing board, composed of the Four Founder Societies.

Alfred D. Flinn

Mr. Flinn will retire as Chairman of the Engineering Division of the National Research Council, a position which he has held since October, 1921, but will continue as secretary of the United Engineering Society in order that the Foundation may continue intimate relations with the Founder Societies. Mr. Flinn has been secretary of this society and of the Foundation since January, 1918, and is widely known by engineers throughout the country. He is a leading figure in engineering movements, including the plan to promote world unity, aid research and more thorough organization of the profession of engineering in this and other countries.

E. P. OGDEN WITH U. S. BUREAU OF MINES

Ellsworth P. Ogden, who was recently appointed Ceramic Engineer for the United States Bureau of Mines with headquarters at the Ceramic Experiment Station, Ohio State University, Columbus, Ohio, is an alumnus of Ohio State University of the Class of 1905. His engineering experience in the field of ceramics is good preparation for the service he has undertaken.

Mr. Ogden designed and built the Clay Craft Brick Company's plant at Shawnee, Ohio, in 1908, the original plant of the Murphysboro Paving Brick Company, Murphysboro, Illinois, in 1909, and the Harris Brick Company's plant, Zanesville, Ohio, in 1910. For three years he was factory engineer for one of the large terra cotta companies with duties at their five plants. Subsequently he has been engaged in the adaptation of producer gas to the firing of heavy clay wares, the manufacture of high voltage electrical porcelain, continuous tunnel kiln design and operation, floor and wall tile manufacture, vitreous enamel work. Mr. Ogden has been a member of the American Ceramic Society since 1906.

Ellsworth P. Ogden

U. S. BUREAU OF MINES

Mineral Filler Investigation

In the course of the investigation of mineral fillers, being made by W. M. Weigel, mineral technologist, at the Southern experiment station of the Bureau of Mines, Birmingham-Tuscaloosa, Alabama, three special problems have been studied, *viz:* determination of grain size fillers, involving elutriation and microscopic measurement, followed by methods of calculation; the effect of heat treatment on the physical properties of white clays with respect to their use as fillers; and the utilization of Alabama flake graphite. The size of particle is a basic property of fillers upon which many of the other physical properties depend, consequently considerable work is being done in this direction. Work has been completed on the study of the effect of heat treatment on the physical properties of clays. The lubrication tests on graphite were satisfactory, while results of the moulding tests were negative. Experiments in the use of graphite as a remover of boiler scale were only partly satisfactory, being partly negative. A special investigation has been made of a series of clays from central Georgia and western Georgia with respect to their value as fillers.

U. S. BUREAU OF STANDARDS

Investigation of Vitreous China Bodies

The testing of specimens of vitreous china bodies made and fired in the factories has been completed. Specimens for the determination of porosity, transverse strength, compressive strength, and resistance to impact have been made from 11 commercial bodies fired at cones 6, 8, 10, 12, and 14. With the exception of the compression test, all of this work has been completed.

A meeting of the American Vitrified China Manufacturers Association was held at the Bureau on October 19 for the purpose of hearing a report on the work. All the results were explained and thoroughly discussed, and the data are now being compiled into a formal report.

Tests of Surface Condition of Molded Commercial Glass

A continuation of the work on glass containers with reference to their life in service has disclosed the fact that reheating the surfaces to the softening point retards penetration of moisture and reduces the tendency to disintegrate. This was shown to be the principal factor affecting the resistance of glass surfaces to disintegration rather than the degree of previous exposure of the surfaces to moisture. A study of the absorption of moisture at different temperatures of glasses of various composition is also being made.

Specifications for Biological Glass

The Bureau of Standards is collecting information from the Army, Navy, the Biological Survey, the Public Health Service, and manufacturers of biological products concerning the requirements of glass for this purpose and the desirability of preparing standard specifications covering the same. The Bureau has already assisted manufacturers of biological products in obtaining glass suitable for their use, but the requests have indicated a possible value for more complete specifications.

Bureau of Standards Conference with Vitrified China Manufacturers

A conference with the members of the American Vitrified China Manufacturers' Association was held at the Bureau of Standards on October 19 to discuss the results of the investigative work which the Bureau is doing in coöperation with these manufacturers. At this conference a report was presented by Mr. H. H. Sortwell, of the Bureau, giving the results of tests of china bodies burned in different parts of commercial kilns and also of tests of the same bodies burned to different temperatures in a laboratory kiln at the Bureau of Standards. This was an extensive piece of work as the bodies used by eleven different manufacturers were included and specimens burned to the different temperatures were tested for transverse strength, compressive strength, resistance to impact, and porosity.

In order to eliminate the personal factor in the preparation of the specimens, all of them were made by a representative of the Bureau of Standards, who went to each of the coöperating factories and prepared the test pieces to be burned at the factory.

The results were exceedingly instructive, showing the firing ranges of the different commercial bodies and the effect on strength and other properties of variations in the temperature attained in different parts of the commercial kilns. These results will aid materially in the preparation of specifications for hotel china and it is believed that this coöperative work will also assist the American manufacturers in maintaining the superiority of their product over that of foreign competitors.

A report of this investigation will be published in the near future.

SAGGER INVESTIGATION OF THE BUREAU OF STANDARDS

Within the last few weeks a large number of users of saggers have received from the Bureau of Standards a letter asking what sagger clays they are using. The purpose of this letter was to obtain information which, when properly coördinated, would constitute a survey of practically all the clays used in saggers throughout the United States. The same inquiry has been sent out to the members of the United States Potters Association, the Sanitary Potters Association, and the Tile Manufacturers Association, as well as to many of the manufacturers of electrical porcelain. There are unquestionably a considerable number of potters and tile manufacturers who are not included in the list and who, in consequence, have not received this letter. The Bureau would be glad to hear from all sagger users and invites those who have not received the letter to write voluntarily, giving the names of the clays that they are using, the localities from which they come and the names of producers or dealers from whom they are obtainable. The proportions in which the different clays are used in the sagger mix would be of interest, but it is not necessary that this should be stated.

A large number of responses to the letter of inquiry have been received and they show a very general appreciation of the importance of the investigation of problems relating to saggers as well as a wish, in practically every case, to contribute something to the work.

As a part of the sagger investigation, the Bureau is undertaking a study of the properties of practically all of the types of clays used in sagger making by American manufacturers. This in itself is an undertaking which will require considerable time, but the results of this part of the investigation will be made available as soon as this part of the work is completed. In order to obtain samples which would represent, as fairly as possible, commercial shipments and avoid the embarrassing questions that might otherwise arise as to the reliability of the results of the tests, the samples to be used in the investigation are being contributed by the users from their regular stocks. A large

number of samples, in two-hundred pound lots, are being shipped to the Bureau, freight prepaid, by purchasers, and the Bureau wishes to express its appreciation of this coöperation.

In order to forestall the inevitable question as to how far the Bureau will go in making public the results of tests of the various clays, it should be stated that the Bureau will follow its usual policy of withholding the names of brands and producers from publication. This appears to be necessary on account of the fact that the Bureau cannot control the future production of any grade of material and consequently the results of the tests made on any given clay, even assuming the sample to be representative of the clay at the time the tests were made, would be misleading if the brand were later to be improved or the reverse. The clays tested will be identified in the report by numbers, and the Bureau will be willing to give each user the numbers of the clays that he is using. Producers and dealers can obtain the numbers of their own clays with the understanding, of course, that this information shall not be published nor in any way used in advertising.

The study of sagger problems is no new thing and it is not to be expected that even the most important questions are going to be cleared up all at once, but it is the hope of the Bureau of Standards to contribute something within the next few months which will at least help to reduce the drain upon many manufacturers from the unsatisfactory service of saggers and possibly in some cases from expense occasioned by the use of clays requiring unnecessarily long hauls.

TWENTY-FIFTH ANNIVERSARY OF CERAMIC SCHOOL AT BUNZLAU, GERMANY

On November 4, 5, and 6, 1922, friends of the Ceramic School at Bunzlau gathered to celebrate the completion of twenty-five years of work by the school under the direction of Dr. W. Pukall. Dr. Felix Singer, a member of the AMERICAN CERAMIC SOCIETY, is on the Board of Directors of this school.

NATIONAL BRICK ASSOCIATIONS WILL MEET IN CLEVELAND IN 1923

The National Brick Manufacturers Association and the Common Brick Manufacturers Association will meet at Cleveland, Ohio, the week of Feb. 5, 1923. The fact that these organizations will gather at the same time and place augurs well for a record attendance, and Cleveland's central location is an added argument. The Hotel Winton will be headquarters for both conventions and all sessions and functions will occur there.

CALENDAR OF CONVENTIONS

American Association of Ice & Refrigeration—Washington, D. C., Probably March 1923.
American Association of Museums—Charleston, S. C., May, 1923.
AMERICAN CERAMIC SOCIETY—Pittsburgh, Pa., Feb. 12–16, 1923.
American Concrete Institute—Cincinnati, Ohio, Jan. 22–25, 1923.
American Engineering Standards Comm.—29 W. 39th St., New York City, Dec. 14, 1922.
American Face Brick Association—West Baden, Ind., Dec. 5–7, 1922.

American Foundrymen's Association—Date not determined.

American Institute of Mining and Metallurgical Engineers—New York City, Feb. 19–22, 1923.

American Malleable Castings Assn.—Cleveland, Ohio, Jan. 9–10, 1923.

American Metric Association—Boston, Mass., Dec. 30, 1922.

American Society of Mechanical Engineers—New York City, Dec. 4–8, 1922.

American Society of Refrigerating Engrs.—New York City, Dec. 4–6, 1922.

American Society for Testing Materials—Place not determined, June 1, 1923.

American Zinc Institute—St. Louis, Mo. or Atlantic City, N. J., First or second Monday in May, 1923.

Association of Scientific Apparatus Makers of the United States of America—Bureau of Standards, Washington, D. C., April 20, 1923.

Canadian National Clay Products Association and Western Ontario Clay Workers Association—Hamilton, Ont., January 24–26, 1923.

Chamber of Commerce of the U. S. A.—Place not determined, Week of May 7, 1923.

International Chamber of Commerce—Rome, Italy, Week of March 19, 1923.

Clay Products Association—Chicago, Ill., Third Tuesday each month.

Common Brick Mfrs. Association of America—Cleveland, Ohio, Week of Feb. 5, 1923.

Federated American Engineering Societies—Place not determined, Date not determined.

Manufacturing Chemists Association—New York City, June, 1923.

Mining and Metallurgical Society of America—New York City, December 7–13, 1922.

National Association of Mfrs. of Pressed and Blown Glassware—Pittsburgh, Pa., March 13, 1923.

National Association of Mfrs. of U. S.—New York City, Week of May 14, 1923.

National Association of Stove Mfrs.—Richmond, Va., May 9, 1923.

National Association of Window Glass Mfrs.—Place not determined, Date not determined.

National Association Builders Board of Control—Des Moines, Iowa, February, 1923.

National Bottle Mfrs. Association—Atlantic City, N. J., Last of April, 1923.

National Brick Mfrs. Association—Cleveland, Ohio, Week of Feb. 5, 1923.

National Canners Association—Atlantic City, N. J., Week of Jan. 22, 1923.

National Exposition of Power and Mechanical Engineering—New York City, December 7–13, 1922.

National Gas Association of America—Louisville, Ky., Spring, 1923.

National Jewelers Board of Trade—New York City, January 18, 1923.

National Paving Brick Mfrs. Assn.—Place not determined, Date not determined.

Sanitary Potters Association—Pittsburgh, Pa., Monthly Meetings.

Stoker Mfrs. Association—May or June, 1923, Place not determined.

Tile Manufacturers Credit Assn.—Beaver Falls, Pa., Quarterly Meetings.

U. S. Potters Association—Probably Washington, D. C., December 10, 1922.

NEW DEPARTMENT OF CERAMICS AND CLAY TESTING IS ORGANIZED

The University of Colorado has been given a small appropriation to start a Department of Ceramics and Clay Testing under the leadership of Professor R. D. George of the Geology Department. The other ceramic departments in the country will be interested in the welfare of the youngest addition to their family circle.

MEMBER OF THE AMERICAN CERAMIC SOCIETY WINS HONOR

W. H. Fulweiler, of Philadelphia, has been awarded the Grasselli Medal for his paper on "Chemical Problems in the Gas Industry," which he presented at the March 1922 meeting of the Society of Chemical Industry.

The Grasselli Medal is endowed by the Grasselli Chemical Company of Cleveland, Ohio, and is awarded by a Committee of the N. Y. Section of the Society of Chemical Industry for the paper presented during the previous year, that in the opinion of the Medal Committee offers the most useful suggestions in applied chemistry. The medal has been in existence for several years and has been awarded twice, the previous award being to Dr. Allen Rogers.

The medal was presented at a meeting of the Society of Chemical Industry held at the Chemists' Club, New York City, on October 20. Dr. H. S. Miner, Chief Chemist of the Welsbach Company and Vice-Chairman of the New York Section, made the presentation.

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Abstractors: E. N. Bunting, W. M. Clark, L. H. Cole, James L. Crawford, R. R. Danielson, G. S. Fulcher, S. L. Galpin, R. F. Geller, James Hepplewhite, H. P. Hood, R. M. Howe, Seiji Kondo, A. T. Malm, R. J. Montgomery, Louis Navias, C. W. Parmelee, C. M. Saeger, Jr., H. G. Schurecht, R. B. Sosman, H. F. Staley, E. W. Tillotson, F. A. Whitaker.

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General and Miscellaneous

1. Glimpses of Ohio ceramic industries. I. CHESTER H. JONES. *Chem. Met. Eng.*, **25**, 562–66(1921).—Ohio holds first place among the states in the production of ceramic wares, producing about 24 percent of the total annual output of claywares in the U. S. General descriptions are given of the processes used in making chem. stoneware at the plant of the U. S. Stoneware Co. at Akron and in making common stoneware at the plant of Ramsbottom Bros.' Pottery Co. at Roseville. H. F. S.

2. Fine grinding. No. 2. The influence of the shape of the particle. L. G. HILL. *Trans. Ceram. Soc.*, **19**, 3–13(1920).—It is stated that the Griffin mill has proven satisfactory for preliminary grinding of pottery materials when followed by magnetic separation of iron particles and wet pan grinding. H. F. S.

PATENTS

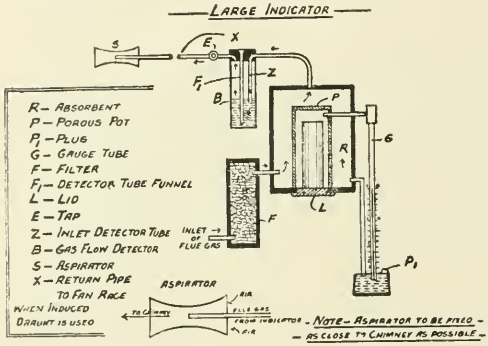
3. Alkali silicates. F. J. PHILIPS and E. J. ROSE. Brit. 151,339, June 19, 1919. In order to obtain a sol. alkali silicate of high silica content, the product obtained by the fusion of alkali and silica is dissolved in H_2O and an acid then added, whereby gelatinous silicic acid is thrown down, and this ppt. by continued agitation is made to redissolve in the soln. The acid, preferably H_2SO_4, may be added in the form of spray; and after the subsequent operation of agitation or grinding, the soln. may be evapd. to dryness. Moreover, to increase the fusibility of the alkali and silica, a little borax may be employed in the fusion process. (*C. A.*)

4. Process for treating clay. JOHN H. RYAN. U. S. 1,385,716, July 26, 1921. The process of treating clay consisting first, in breaking the same into small lumps and then drying in the presence of heat for the purpose of a preliminary oxidization, mixing with a surplus of water to settle out any grit, adding thereto ammonia to neutralize any acid in the clay, introducing the pulp into a pebble mill to grind the same and to thoroughly admix the ammonia therewith, next adding a bleaching agent, of one-half of one percent of the water content, and continuing the action of the pebble mill for a period of substantially two hours to fully admix the chem. therewith and secure its action, thereafter diluting the pulp to draw the same from the mill and subjecting it to an agitator to entirely dissolve and remove the chem. settling, and decanting the water, withdrawing the pulp and filtering the same, and subjecting the thick pulp to a drying action to finish the product. C. M. SAEGER, JR.

5. Dry-kiln. JOSEPH F. HIRT. U. S. 1,385,451, July 26, 1921. A kiln having a drawing chamber and a heating chamber; means for circulating air through the chambers; means whereby fresh air is admitted to the circulating air at a point where it will pass through the heating chamber before entering the kiln chamber, thereby thoroughly mixing and heating the additional fresh air with the recirculating air, before entering the drying chamber; means for supplying humidity to the air before it enters the drying chamber; and means for varying the amt. of humidity supplied to various portions of the kiln. C. M. SAEGER, JR.

Apparatus and Instruments

6. **Scientific control of combustion.** H. T. RINGROSE. *J. Iron and Steel Inst.* (Adv. copy No. 8), 9 pp. (1921); *Engineering*, **111**, 565–66; *Engineer*, **131**, 511–12; *Iron and Coal Trades Rev.*, **102**, 628–29.—An app. and a method are described for recording automatically and continuously the *amt. of CO_2 in flue gases* by measuring on a manometer tube the amt. of vacuum obtained in a porous pot containing a soda-lime absorber and surrounded by an atm. of flue gases, the amt. of vacuum produced depending solely on the % of absorbable gas surrounding the pot. It measures very small amts. of CO_2 even that in ordinary air or about 0.04%. The quickness or responsiveness of the indication depends solely on the porosity of the pot. The app., as shown in the figure, consists of an aspirator connected to the flue under observation, a filter and a chamber contg. the porous pot, inside which is the dry absorbing reagent. A pipe connects the chamber with a vessel of water, into which dips one end of a graduated tube, the other end being extended into the porous pot. As soon as absorption begins, the vacuum produced and the % of CO_2 are read off directly. Another similar app., the W. R. Producer CO_2 Indicator, has been devized for measuring *the CO_2 in producer gas*. For neutralizing the effect of the H another similar pot is provided with a dummy cartridge with no absorbent and H is passed through setting up in both pots opposing diffusion pressures; the difference in reading on the manometer tube is proportional to the per cent of CO_2 in the mixt. It is accurate to within 0.0–0.6% as compared with an Orsat app. This affords a direct and scientific control of producer gas quality. Attempts are being made to design an instrument so sensitive as to show variations in CO_2 in a water-gas plant from second to second instead of the av. over a certain period. J. L. WILEY (*C. A.*)


LARGE INDICATOR
R – ABSORBENT
P – POROUS POT
P1 – PLUG
G – GAUGE TUBE
F – FILTER
F1 – DETECTOR TUBE FUNNEL
L – LID
E – TRAP
Z – INLET DETECTOR TUBE
B – GAS FLOW DETECTOR
S – ASPIRATOR
X – RETURN PIPE TO FAN RACE WHEN INDUCED DRAUGHT IS USED
INLET OF FLUE GAS
ASPIRATOR
TO CHIMNEY
FLUE GAS FROM INDICATOR
AIR
NOTE – ASPIRATOR TO BE PLACED AS CLOSE TO CHIMNEY AS POSSIBLE

7. **The Avrutik continuous and automatic shifting process for separating liquids and solids.** JOSEPH AVRUTIK. *Louisiana Planter*, **66**, 379–80(1921).—A design of the app. and description of the principles involved are given. Three centrifugal baskets placed one above the other, and permitting an overflow for solids from the upper basket into the lower baskets, are the principle features of the app. The material under treatment can be washed as desired. C. H. CHRISTMAN (*C. A.*)

8. **New testing machines. II. Hardness testing machines.** E. IRION. *Z. Ver. deut. Ing.*, **65**, 315–20(1921).—Five new instruments for measuring

the *hardness of metals*, four by the Brinell method and one by the Martens-Heyn method, are described. F. P. Flagg (*C. A.*)

9. The Atkins centrifugal filter press. Anon. *Caliche*, **2**, 148(1920).—The advantages which the rotation of the filtering medium is stated to give are: (1) Continuous elimination of the solids from the filter cloth by the centrifugal action due to the rotating filter disks. (2) The solid materials are deposited in the form of a paste on the walls of the container. (3) The filtered soln. discharges immediately and does not accumulate. (4) Either pressure or vacuum may be used. (5) Discharge of the solid materials is continuous. The app. (of which drawings are given) consists in principle of several circular filtering disks mounted on a shaft which may be rotated, the whole being enclosed in a tank or container to which pressure may be applied.

C. L. Burdick (*C. A.*)

10. Drying stoves scientifically designed. B. J. Allen. *Trans. Ceram. Soc.*, **19**, 26–41(1920).—A description of the conveyor type of pottery dryer now used in the U. S. A. H. F. S.

11. A new centrifugal filter press. C. R. Platzmann. *Tonind. Ztg.*, **45**, 1081–82(1921).—A new centrifugal filter press made by Stancourt, Son's and Muir Ltd., London, is described. The substance to be dewatered is fed into the center of the centrifuge which rotates at about 45 revolutions per sec. and the slip is thrown with great force (1 kg. per cm.^{2}) against a filtering medium. The dewatered clay is thrown against the outside of the centrifuge while the water is forced out below. When the chamber inside of the centrifuge has become filled with clay the operation is stopped until same has been removed. This is done by raising the outer shell. This takes about 2 min. and 2 men can operate 4 filter presses. The coarse material is separated from the fine in this filter press which for certain purposes is an advantage. This press requires less space than others and permits the use of high pressures.

H. G. Schurecht

12. Uehling carbon dioxide recorder. Anon. *Engineering*, **111**, 626–27 (1921).—A const. flow of flue gas is drawn through a chamber containing an absorbing medium. The CO_2 in the stream is absorbed and the resulting change in pressure is recorded by a manometer graduated directly in per cent CO_2. 4 illus. H. Buttler (*C. A.*)

PATENTS

13. Thermocouple for high-temperature measurement. T. Takizawa, J. Tsukamoto and Tokyo Denki Co. Japan 36,602. June 15, 1920. A couple is made of W and Mo wires, enclosed in a porcelain tube, which is maintained in vacuum or filled with H or A, perferably H at $^2/_3$ atm. It is used for the interval 1500–1850°. The e. m. f. of this couple increases proportionately to the increase of temp. at low-temp. interval; thermoelectric inversion occurs at 530°; the e. m. f. decreases, reaching zero near 1300° and changes direction. The e. m. f. in mv. is as follows: 1500° 2.82; 1600° 3.49; 1700° 4.25; 1800° 5.20; 1900° 6.20. (*C. A.*)

BOOK

14. Pyrometry: A practical treatise on the measurement of high temperatures. CHARLES R. DARLING. 2nd ed. revized and enlarged. 240 pp. 10s 6d net. For review see *J. Inst. Metals*, **25**, 484(1921). (*C. A.*)

See also No. 26.
See also No. 38.

Chemistry, Physics and Geology

15. On a hitherto unknown copper aluminate of the spinel type. J. ARVID HEDVALL AND JOSEF HEUBERGER. *Z. anorg. allgem. Chem.*, **116**, 137(1921).—CuO and Al_2O_3 in the mol. ratios 1:1, 1:2, and 2:1 were heated with 6 to 10 times their wt. of KCl at 850° for an hour and also without KCl at 900° for one week. Microscopical examn. indicated that the product from the 1 : 1 mixt. was homogeneous. The products purified by digestion with dil. HNO_3 to remove excess of CuO or Al_2O_3 yielded a brown powder, the compn. of which corresponded to $CuO.Al_2O_3$. The powder consisted of fairly well formed cubes and octahedra. A study of by-reactions observed when KCl was used as a flux is being made. W. E. T.

16. On the binary systems of lithium orthosilicate with zirconium orthosilicate and calcium orthosilicate. ROBERT SCHWARZ. *Z. anorg. allgem. Chem.*, **115**, 87(1921).—The system Li_4SiO_4–$ZrSiO_4$ was investigated thermally and optically from Li_4SiO_4 up to a compn. containing 70 mol. percent $ZrSiO_4$. A max. in the m. p. curve was found at the compn. $2Li_4SiO_4-3ZrSiO_4$ and a eutectic at 30 mol. percent $ZrSiO_4$. Since no mixed crystals were formed it was possible to calc. the mol. wt. of $ZrSiO_4$ from the lowering of the m. p. This was found to correspond to the simple formula $ZrSiO_4$. The system Li_4SiO_4–Ca_2SiO_4 was investigated up to 60 mol. percent $CaSiO_4$. The m. p. curve is a complicated one indicating mixed crystal formation and showing a max. at 40 mol. percent and 60 mol. percent Ca_2SiO_4. At lower temps. (about 932°) a molecular rearrangement takes place which indicates the formation of the compd. $Li_4SiO_4.Ca_2SiO_4$. The density data and the optical examination support this conclusion. E. W. T.

17. The measurement of the consistency of varnish. H. A. GARDNER AND P. C. HOLDT. Paint Mfgrs. Assoc. of U. S., *Circ.* **127**, 51 pp. (June 1921).—The authors define viscosity, plasticity, rigidity, and viscous and plastic flow. Abs. viscosities obtained with the Bingham variable pressure plastometer (*C. A.*, **14**, 1047) fitted with a modified receiver, on 37 different varnishes of various types ranged from 0.6 to 5.5 poises at 25°; these are tabulated against results obtained with the MacMichael and Doolittle torsion viscometers. Details of the operation of the instruments, calcn. of the capillary const. of the plastometer, discussion of accuracy, etc., are given. The MacMichael operated at accurately controlled low speeds and temp., might be used for research and routine work but it is not as accurate as the plastometer and exhibits a tendency to indicate viscosities lower than the true values. The Doolittle appears best adapted for routine testing although its readings can not

be calcd. to abs. viscosities. The Stormer and the Hadfield-Bawtree (*C. A.*, **15**, 180) viscometers are described. The occurrence of plasticity in varnishes can not well be explained on the hypothesis of solid friction, because ultramicroscopic examn. shows very few solid particles; but it may be due to emulsoid aggregates forming a continuous structure through the varnish.

F. A. WERTZ (*C. A.*)

18. Molecular force and plasticity of clays. HERBERT CHATLEY. *Trans. Ceram. Soc.*, **19**, 1–2(1920).—Suggestion is made that plasticity (and also, when the molecules of the fluid are considered, the specific "colloid" properties of sub-divided matter) is due to the presence of molecular forces comparable with wt. or other external agency. H. F. S.

19. Equilibria of hydrofluosilicic acid. LAWSON J. HUDLESTON AND HENRY BASSETT. *J. Chem. Soc.*, **119**, 403–16(1921).—The present accepted method of testing for silica in HF by adding KCl with formation of turbid K_2SiF_6 is found to be inadequate. A method of studying the compn. of mixts. of HF and H_2SiF_6 is found in the fact that for the complete neutralization of the latter acid, according to the equation $H_2SiF_6 + 6NaOH = 6NaF + H_2SiO_3 + 3H_2O$, an appreciable time is required. Thus when NaOH is added to the mixed acids the time may be measured from the moment of mixing till the color of the indicator (phenolphthalein) fades. Other additions of alkali are made until the color no longer fades. Since the total concn. of H ions is produced but slowly, they must be bound in a complex. If n cc. of alkali were originally present and N cc. were required for the total permanent neutralization $(N-n)/N \times 100 = C$ is the percentage of total H ions in bound condition at the moment of fading. The various values of *log C* plotted against time give the straight line usual for a monomol. reaction, from which C_0, the original concn. of the complex present in the unneutralized acid, is calcd. The rate of dissoc. of Na_2SiF_6 into SiF_4 and NaF is detd. The effect of temp. upon the velocity const. is given by the equation $\log k = (-9662/T) + 29.83$. Equil. conditions demand that when SiF_4 is passed into H_2O a considerable proportion of unchanged SiF_4 should be present, and the H_2SiO_3 can exist in soln. with an active mass proportional to its concn. to the extent of at least 0.003 mols. per 1. at 15°. G. L. CLARK (*C. A.*)

20. Influence of surface tension on fusion and solidification. ERNST RIE. *Wien. Anz.*, **1920**, 137–39.—In connection with a communication by Pavlov (*C. A.*, **3**, 860) R. develops an expression for the dependence of the m. p. T_2, of small, cryst. granules on the surface tension, S_{23} (free energy of the surface), in the form $Tp - T_0 = -T_0 \times 2S_{23}/s_3rq$, where T_0 is the limiting m. p. (without reference to surface energy), s_3 the density of the solid phase, r the radius of the cryst. granules considered as spheres, and q the latent heat of fusion. This expression, which is derived from the Gibbs equil. conditions by purely thermodynamic reasoning, and is readily adapted to the case of a drop enclosed within a crystal, gives results differing from those of Pavlov. Further observations of the m. p. of crystals are necessary to decide which of the conditions,

$S_{13} \gtrless S_{12}+S_{23}$ is valid. Probably, the majority of amorphous substances are composed of extremely minute crystals, the size of the granules being $> 10^{-5}$ cm.; the absence of a definite m. p. is to be ascribed to surface tensions. J. C. S. (*C. A.*)

21. **Diffusion in silicate melts.** N. L. Bowen. *J. Geol.*, **29**, 295–317(1921). —In order to determine exptly. the rate of diffusion in fused rock-forming silicates the following procedure was employed: a layer of diopside was placed in the bottom of a crucible with a layer of plagioclase above it, diffusion was permitted at constant temp. (above the melting temp. of both layers) for a definite period, the charge was quenched and the compn. determined at various depths by measuring the n of the glass. From these expts. it would seem that the movement of large amts. of material through long distances by diffusion can not be credited when the rate at which the magma must cool is considered. On the other hand, diffusion through short distances is possible and such phenomena as the formation of reaction rims about foreign inclusions are to be attributed to diffusion, though for very wide rims (2 m.) a considerable period of time (100 yrs.) will be required. W. F. Hunt (*C. A.*)

22. **Kaolin in Belgium.** E. Asselberghs. *Ann. Mines Belg.*, **21**, 1059–67(1920); *Rev. geol.*, **1**, 292–93(1920).—Previously known deposits are discussed briefly and a new occurrence is described in detail. The kaolin from Ardenne is shown by a series of analyses to contain but 40% of impurities, which can be removed by levigation, yielding a product capable of competing with those of Devonshire and of Cornwall; the latter in fact has to be sepd. from 75% of impurities. E. T. W. (*C. A.*)

See also No. 25.

Refractories and Furnaces

23. **The function of insulation and its application to heat-treating furnaces.** E. F. Davis. *Trans. Am. Soc. Steel Treating*, **1**, 33–42(1920).—The requirements of insulators from the viewpoint of efficiency are given. Heat loss from a horizontal surface is 22% greater than from a vertical surface. W. A. Mudge (*C. A.*)

24. **Properties and preparation of ceramic insulators for spark plugs. I. Methods of measuring resistance of insulators at high temperatures.** F. B. Silsbee and R. K. Honaman. *Nat. Advisory Comm. Aeronautics, Fifth Annual Rept.*, 1919, 77–89(1921).—Measurements were made at 200°–900° with both a. c. and d. c. at voltages up to 2000. Resistance decreased rapidly with increase in temp. in porcelain, mica, fused SiO_2, and similar materials but there are no sudden changes. A convenient comparison figure is the temp. (T_ρ) at which the resistivity is 1 megohm per cc. This temp. for various substances is: fused SiO_2, 890°; best porcelain tested, 790°; typical mica plug, 720°; av. of 3 aviation porcelains, 650°; av. automobile porcelains, 490°. In the measurements with d. c., polarization effects disturbed the readings. The mechanism of conduction in this class of materials is exceed-

ingly complex and merits wide investigation. **II. Electrical resistance of various insulating materials at high temperatures.** R. K. HONAMAN AND E. L. FONSECA. *Ibid.*, 91–99.—To obtain reliable findings, tests were made at 550 v., 60 cycle, a. c. Polarization was thus avoided. Cond. increased about 2% per degree. The temp. (T_e), at which resistivity was 1 megohm per cc., varied from 870° for fused quartz to 280° for some kinds of glass. Many findings are recorded. Porcelains developed at the Bureau of Standards showed as high as 800°. Most spark-plug porcelains show about 500°. Any material with T_e less than 400° should be used only when the design of the plug is such that the insulator is very well cooled. **III. Preparation and composition of ceramic bodies for spark-plug insulators.** A. V. BLEININGER. *Ibid.*, 101–107.—Spark plugs in airplane engines are subjected to high temps., sudden heating and cooling and mechanical stresses. A suitable material, therefore, must remain a good insulator at the max. temp. reached, not be subject to permanent vol. changes, possess const. thermal expansion and be strong and tough. The best types developed at the Bureau of Standards are given. No. 152 contained: Georgia kaolin, 10; Florida kaolin, 10; N. Car. kaolin, 10; Del. kaolin, 10; Calcine No. 19, 40; Calcine No. 14, 20%. Calcine No. 19 contained: Kaolin, 70.2; Al_2O_3, 27.8; B_2O_3, 2.0%. Calcine No. 14 contained: Kaolin, 56.0; $MgCO_3$ (pptd.), 18.2; potter's flint, 25.8%. Another excellent porcelain was No. 194 containing: Beryl, 35.0; Georgia kaolin, 12.5; Florida kaolin, 12.5; N. Car. kaolin, 12.5; Del. kaolin, 12.5; potter's flint, 15.0%. C. H. KERR (*C. A.*)

25. An organism producing magnesia. M. GIGNOUX. *Compt. rend. somm. soc. géol. France*, Feb. 4, **1918**; *Rev. geol.*, **1**, 72(1920).—As bearing on the problem of the origin of dolomite, it is pointed out that there is a very common protozoan, *Trichosphaerium*, the skeleton of which is formed entirely of $MgCO_3$. E. T. W.(*C. A.*)

26. Behavior of clay pyroscopes and fireclay bricks in coal gas. L. BRADSHAW AND W. EMERY. *Gas World*, **74**, 503-504(1921).—From the Report of the Refractory Materials Research Comm. of the Institution of Gas Engineers. Seger cones, when heated in coal gas to temps. well above their ordinary softening points, remained erect. On examn., they were found to consist merely of a hollow shell with a quantity of slag discharged at the base, or of a semi-vitrified mass covered with an infusible skin. The outer shell was extremely refractory. It appeared to be due to the formation of a thin film of hard carbon in intimate contact with the surface of the cone. This effect was found to be due to the decompn. of CH_4 which forms a peculiarly hard and lustrous type of carbon (cf. Bone and Coward, *C. A.*, **2**, 3061). Fireclay brick heated under the same conditions assumed a similar surface deposition. The idea of a protective coating of hard carbon artificially produced on fireclay surfaces might possibly be utilized in gas works practice, as the refractoriness of the shell is very much higher than that of the untreated material. J. L. WILEY (*C. A.*)

27. The vapor pressures of SiO_2, Al_2O_3, CaO and MgO. OTTO RUFF AND PAUL SCHMIDT. *Z. anorg. allgem. Chem.*, **117**, 172(1921).—This report

presents the results secured using the app. and method described in earlier papers (*Z. anorg. Chem.*, **82,** 373(1913); **106,** 76(1919)).—In certain of the expts. Ar. was used as a furnace atm. and the graphite container was glazed with a mixt. of 3 parts of vanadium carbide and one part of vanadium oxide. The boiling points observed are as follows: Al_2O_3, 2210°; SiO_2, 2230°; CaO, about 2850° and MgO, about 2800°. For the first two oxides linear logarithmic v. p. curves were obtained. It is planned to repeat the work using a tungsten container and an atm. of Ar. E. W. T.

28. Symposium on gas firing. Dr. E. W. Smith and others. *Trans. Ceram. Soc.*, **20,** 20–38(1920).—The cost of mfg. producer gas as compared with coal gas and blue water gas, is in the relative proportion of 3, 4 and 5. Almost any combustible fuel can be employed, providing it is of reasonably constant quality. In most industrial operations, where the gas has not to be distributed, and where the application is sufficiently large to put a producer in the setting of the particular furnace, the internal producer is the cheapest form to run. With an internal producer, it is possible to obtain a hot gas, with an effective c. v. of between 155–160 B. t. u. per cubic foot. Up to 20 percent of heat can be saved by using hot gas in preference to cold. It will pay to sacrifice a little efficiency in gasification, if the labor costs can be reduced considerably. By the adoption of a step grate, clinker troubles will be minimized, but loss of carbon in the ash occurs. By complete gasification of coal it is possible to obtain per ton of fuel about 50,000 ft. of gas of a thermal value of about 360 B. t. u. with inerts of about 6 percent, including the N and the CO_2. The plant is as easy to manipulate as a blue water gas plant; and will use either coke or coal. It will probably never be possible to make gas by means of complete gasification as cheaply as producer gas, and since all industrial operations of any magnitude only require a gas of producer gas quality, producer gas will continue for some time to be the gas that is mainly used. J. Dunnachie.—Gas-firing will save 50% of the fuel that is consumed in a direct-fired kiln, apart from which there is considerable saving also in labor. Gas-firing makes it possible to centralize the work, and obviates the necessity of distributing fuel to, and ashes from, kilns scattered about. The wear and tear on a gas-fired kiln is also considerably less than in the case of a coal-fired one. There is a danger of gas kilns being too elaborate and complicated in the way of flues and dampers. S. T. Wilson.—For goods that require an oxidizing fire and equal temp. gas-firing can only be safely adopted where the gases are so intimately mixed as to produce surface combustion, and if they are burnt in the combustion chamber then they will lose their heat very quickly as they travel across the oven. For this reason the oven must have a very small cross-sectional area, too small for a man to work in but large enough for a tunnel oven. Where the goods to be fired are not injured by contact with the combustible gases or air, then gas can be safely used with recuperation because streams of gas and air can be placed at such an angle that combustion will take place all along its path across the oven and so one end of the flame can be made as hot as the other and consequently

an even temp. can be produced. Large chamber ovens can be used in this case. Col. C. W. Thomas.—The gaseous-fired kiln or furnace is economical because of recuperation or regeneration. It is not so much in the change from solid to gaseous fuel that economy is realized as in the method by which the regenerative system of firing is carried out. For some years Col. T. has had in use an ordinary 28-chamber continuous kiln, coal-fired, burning ordinary firebrick sizes up to 3 and 4 inches thick, to a temp. of cone 9 down; the fuel used has been the ordinary fuel of the S. Staffordshire district, in the form of small nuts. The waste gases have been taken to the chimney at a temp. of from 150° to 200°C, and the consumption of fuel has varied between 2.2 and 1.8 cwts. to the ton of fired material. No figures have been reported for gas-firing which have been lower than those. From the point of view of fuel economy every kiln in which the waste gases are allowed to go to the chimney at anything over 150° or 200°C is sheer waste. Everybody, sooner or later, will have to come, if not to gaseous firing, to recuperative or regenerative firing. H. F. S.

PATENTS

29. Basic refractory material. Harry P. Bassett. U. S. 1,390,328, Sept. 13, 1921. The herein described basic refractory material comprises double burned dolomite, an oxide of a metal of the iron group, an alkali metal compd. and a silicon compd.

30. Acid-proof refractory composition. Harry P. Bassett. U. S. 1,390,-327, Sept. 13, 1921. The herein described acid proof refractory composition comprising silica, a metal comprised within the iron and aluminum groups, an alkali metal coumpound and a silicate binder.

31. Apparatus for heating by combustion without flame. Maurice Mathy. Belgium. U. S. 1,388,355, Aug. 23, 1921. A furnace having one or more of its heating walls in the form of boxes containing a mass of fragmentary porous, refractory material in the heart of which flameless combustion of a gaseous mixt. takes place.

32. Kiln. Harford P. Jenks. U. S. 1,386,116, Aug. 2, 1921. A kiln provided with a perforated floor, a checker-work heat-reservoir located below the floor and adapted to receive the hot gases passing through the perforations of the floor, a down-take located at the edge portion of the reservoir and forming an outlet therefor, and a flue connected with the lower portion of the down-take and having an imperforate upper wall extending along the lower portion of the heat-reservoir, and in contact, throughout its length, with the bottom wall of the reservoir.

33. Tunnel-kiln with sectional combustion-chambers. Philip D'H. Dressler. U. S. 1,384,435, July 12, 1921. In a continuous tunnel kiln, the combination with a kiln chamber having an elongated hot zone, of a plurality of combustion chambers arranged in an end series extending longitudinally of the hot zone and having air and gas inlets at one end and an outlet for products of combustion at the other end and of such proportions that the distance between the inlet and outlet of each chamber is several times the max. transverse dimension of the chamber.

34. **Parallel-current calcining-kiln.** HARRY E. BROOKBY. U. S. 1,390,335, Sept. 13, 1921. A common direction, parallel current, calcining kiln having a rotary shell, a combustion chamber projecting into the shell, and means for introducing the charge into the shell and passing it over a portion of the surface of the combustion chamber for raising the temp. of the charge and lowering the temp. of the gases of combustion before the two mingle in the shell. C. M. SAEGER, JR.

Whiteware and Porcelain

35. **Note on the formation of blow-holes in earthenware glazes.** J. BARLOT. AND JH. MARTINET. Univ. of Besançon. *Chimie & industrie*, **5**, 651–52(1921). —The most frequent defects found in the enamel of white panels were due to various impurities (Fe and Cu oxides, dirt from the ovens, etc.) or to excessively large grains in the layer immediately under the enamel. These grains often consist of $CaCO_3$, which causes shallow and irregular holes in the surface of the enamel owing to the liberation of CO_2. Another defect consisted of small round, funnel-shaped cavities, in the bottom of which could nearly always be found a small black particle. Microchem. anal. showed the presence of S by transformation into $CaSO_4$, and also of Fe, which results from the decompn. of FeS_2 into FeS and S. A. P.-C. (*C. A.*)

36. **High fire porcelain glazes.** H. H. SORTWELL. *Bur. Standards, Tech. Paper*, No. **196**; *This Jour.*, **4**, 718–30(1921). H. F. S.

37. **Unestimated losses in pottery manufacture.** *Trans. Ceram. Soc.*, **19**, 14–25(1920).—**Works blindness.** J. W. MELLOR.—Works blindness is a kind of disease attended by the blunting of the observational powers due to constant association with a particular works or process.

Recovery of gold residues. C. D. GRIMWADE.—The recovery of the gold is achieved by burning the rags, brushes, and other paraphernalia used by decorators, either in applying gold to ware or in cleaning up and in fusing the ash to a clear glass. A mixt. which has proved very suitable is: Ash 12 oz., borax glass 10 oz., potassium nitrate (nitre) 2 oz. No benefit could be observed from covering the mixt. with a layer of salt.

Wad clay. BERNARD MOORE.—The diff. in the amount of wad clay used between using a wad 0.3 inch and one 0.7 inch, is that the one is more than 5 times the wt. of the other. Within reasonable limits, the less wad clay used, the less dirty ware will the oven yield. In the Research Laboratory at Stoke, square wads are cut the right size to put on the saggars. These are of more uniform texture than squeezed wads. H. F. S.

38. **Some new appliances in potting.** A. S. W. ODELBERG. *Trans. Ceram. Soc.*, **19**, 42–49(1920).—**Electric carrier.** By means of an electrically operated overhead monorail conveyor, saggars filled with fired ware "wander" quite independently from the oven to the warehouse where they are emptied while in movement by the sorter, without removing of the saggars from the carrier. The saggars when empty return to the placing room near the oven, where they are taken from the carriers at the most convenient spot. A similar

arrangement is used for emptying the glost kiln and taking the goods from the glost warehouse through the other warehouses to the packing shed. The system requires about 50% of the labor formerly employed.

Modification of Schöne's apparatus. A simple app. in which only one can is used and one sepn. made.

Jolleying square dishes. A perfectly rigid jolley is used with all the necessary movement in the jigger head. This is effected by means of a guide plate fixed on the bench. In this guide plate is a groove in which a stud projecting from the jigger head runs dead true. The groove is of very peculiar shape, and has to be determined empirically by reversing the process. The shape wanted is first modeled, and then placed on the jigger head, fitting exactly to the profile of the rigid jolley. Instead of the stud in this case a pencil or needle is fixed to the jigger head, and made to trace the path of the groove on a plaster bat fixed on the bench, simply by turning the jiggerhead so that the mould runs true to the profile. The cast iron guide is then modeled from the plaster bat. It has been found that a man with this machine will make as many articles as with the ordinary oval jigger and jolley, including both flat and hollow ware.

Plate-making machinery. This is constructed according to the latest English pattern with cast iron frames so as to get as much rigidity as possible. The jolley is provided with loose profiles adjustable in the usual manner by means of a nut. The batting machine has a separate frame so as to prevent any jarring in the plate-making machine. It is semi-automatic; the moment the profile is pressed down the jigger head begins to revolve.

Insulators. These are also made by a jigger and jolley instead of by a "monkey." By lengthening the jolley arm and fixing it in an inclined position it is possible to make the profile lift vertically and deliver easily. When the insulators are turned and thoroughly dry, a groove must be made at the top for the wire. The work is accomplished by means of a felt wheel acting like a circular saw and running at 4000 rev. per min. It is partially enclosed in a casing connected with a fan. The groove of the insulator is made in a few seconds, and considerable labor is saved.

Cup and mug handles. These are formed in steel dies heated by an elec. "resistance" fixed inside. The top die is kept somewhat hotter than the bottom one, which facilitates delivery. In this process no oil is needed to make the clay deliver readily from the steel die, and after cooling, the handles are ready to be fixed to the cups.

Heating channels from the ovens. A brick flue (about half a meter square) was built from two ovens. The outlet from the ovens was just over the arch. An extra damper was placed at the top of the cooling cone, and an extra flue provided with a damper was made to connect with the outside air. A motor driven Blackman's fan (70 cm. diam.) was used. After the oven had cooled a little, both the top cone damper and the main flue (bottom) damper were closed, and the motor started. In order that the air should not be so hot as to injure the fan, the shaft or the bearings, the damper of the cold-air flue was

opened in order to bring about a partial cooling. In this way the fan maintained for several days a steady current of air at about 300°C flowing through a drying mangle, and this was quite an efficient subs. for steam. The fan consumed daily 30 to 40 units corresponding to 40 kg. of coal. The boilers consumed 4500 kg. coal, 15% of which amounts to 670 kg. coal, which is the quantity of coal equiv. to the steam formerly consumed in the mangle. Thus at the expense of 40 kg. coal, heat corresponding to 670 kg. coal was obtained. H. F. S.

39. **Whiteware glaze defects and their prevention.** Max Schmidt. *Keram. Rundschau*, **29**, 341–42, 365–66, 389–90, 412–13, 435–36(1921).—In the prepn. of frits, boric acid is partly volatilized whereby the fluxing effect of this ingredient is partly lost. If S is present in the furnace gases, it combines with the alkalies of the glaze forming a scum known as "gall." During the wet grinding of the glaze these sulphates go into soln. The introduction of kaolin into the frit during the melting process is advizable since this keeps the mass porous, thus promoting oxidation. In the wet grinding of glazes there is a tendency for the glaze to settle and to set similar to cement. This is due to the formation of sodium silicate which causes the cementing. By adding vinegar, dil. HCl, or NH_4 salts, this trouble may be overcome. When this add. is made there is a big increase in vol. due to the formation of silicic acid. To prevent trouble due to this source it is advizable to first add $^1/_3$ of the necessary deflocculent when charging the mill and the other $^2/_3$ after the charge has been ground. The flaking of dry glazes from pottery is due to too fine grinding and too plastic clays. This trouble may be overcome by subs. calcined kaolin for some of the raw clay. It is also advizable to soak the piece with water in order to remove entrapped air from the bisque pottery. The presence of sol. sulphates in clays often causes the dry glaze to scale from the pottery especially along edges. This may be overcome by adding Ba salts to the clay. In firing glazes the soln. of the pottery body by the glazes is an important factor. This often causes the glaze to have a matt appearance. To overcome this the introduction of Al_2O_3 into the glaze is recommended and also more rapid firing during the glost burn. Sulphur in the kiln gases also causes dry spots on glazes and the saggars should therefore be well glazed. Seger's rule which states that crazing may be reduced by subs. a metallic oxide of lower equivalence for one of higher equivalence does not hold true for borax free glazes. Crazing may be reduced by reducing the alkali content, subs. K_2O for Na_2O, or by the subs. of MgO or ZnO for PbO. Too much MgO causes the glaze to become too viscous and too much ZnO causes the glaze to become cryst. H. G. Schurecht

40. **The perfection of electrical porcelain.** Thomson-Houston, *Le Génie Civil*, **15** (1921); *Tonind. Ztg.*, **45**, 1041(1921).—A process for making elec. porcelain covered by Fr. pat. 506,861, Aug. 31 is described. This process is based upon the fact that the elec. and mechan. props. of porcelains are improved by subs. certain refractory oxides for some of the SiO_2. Not all of the SiO_2 is replaced by the refractory oxides. For ex. a zirkite

body is composed of the following constituents: 81% $ZrSiO_3$, 14% SiO_2 and the remainder TiO_2, Al_2O_3 and Fe_2O_3. TiO_2 and ZrO_2 are especially recommended as subs. for SiO_2. By heating the common porcelain to 800°C and plunging same in water it becomes very friable while the special body is barely affected by this treatment. The tens. strength of the new body is 7400 instead of 4300. The elec. properties of the special porcelain are the same as those of the common porcelain at ordinary temps. At 280°C the special porcelains have a resistance of 2.43 megohms whereas the common elec. porcelains have a resistance of only 0.8 megohm. The special porcelains also have other valuable props. For ex. they are less porous than ordinary porcelains and contain constituents which are more stable than SiO_2 in heating and cooling. H. G. SCHURECHT

41. The use of the Ulbricht sphere in the measurement of reflection and transmission factors. *Bur. Standards, Sci. Paper*, No. 415. ENOCH KARRER.—A brief historical survey is given of the methods and instruments used in measuring the reflection factor of surfaces. One of the new ways consists in a combination of the sphere with the Martens polarization photometer. The photometer enables a direct comparison to be made between the brightness of the sphere wall and the brightness of the test surface which closes an aperture in the sphere. The sphere wall is illuminated by directing a narrow beam of light through an aperture that is closed by the sample. The sample is illuminated by the sphere wall, but is screened from the direct light from the illuminated spot. The ratio of brightness which is obtained by means of the Martens photometer is exactly the reflection factor of the test surface. Thus the r. f. is determined by one observation without further calcn. and without the use of a standard reflecting surface. This method may be modified so that the transmission factor may likewise be detd. absolutely. A simple and inexpensive reflectometer is also described that may be of service for certain commercial purposes where an accuracy of 10 to 15% is allowable. Some data are given to show that the r. f. of magnesium carbonate in blocks as frequently used in photometry is as high as 98.7%, corroborating some recent detns. by others. The value for magnesium carbonate has until recently been assumed to be 88%. All blocks of magnesium carbonate as ordinarily purchasable have not as high a r. f. They may vary by several percent. H. F. S.

See also No. 24.

Art and Design

42. Art in the pottery industry. (Symposium on Art.) G. M. FORSYTH. *Trans. Ceram. Soc.*, **20**, 2–7(1920).—The word "Art" is used to signify work evincing practical skill in the creation of beauty. "The application of living healthy artistic ideals to pottery manuf. means the soundest economy, and is essentially a business proposition, for the designer or the artist has the last word in production, and the effect of his work is first to sell the goods. It means that good workmanship replaces bad, and that common-

sense beauty replaces extravagant ugliness wherever it exists in any grade of ware for any market in the world. There is today an incessant and increasing demand for well-decorated pottery of a purely utilitarian type." "We deliberately degrade our craft, and then moan about it, saying that we have no skilled men, or we take refuge in saying that 'This is what the public wants,' pure humbug and subterfuge." "It (Art) is the bride of the ages, elusive, forever beautiful, and gifted with eternal youth." H. F. S.

43. A plea for toleration in Art. (Symposium on Art). J. W. MELLOR. *Trans. Ceram. Soc.*, **20**, 11–19(1920).—

> Myself when young did eagerly frequent
> Doctor and saint, and heard great argument
> About it and about; but evermore
> Came out by the same door, where in I went.
> —*Omar Khayyam.*

"There are fashions in Art. Custom will make us satisfied with one fashion until a new one appears. A dream of a hat one season may, the following season, be an ugly nightmare. In countries where men's faces are bare, men with beards are regarded as horrors. The practices of certain nations tattooing the body, painting the skin, putting skewers through the nose or lips, elongating the skull, or distorting the feet, are not regarded as deformities, but are presumably intended to enhance the beauty of the human form. The Hottentots can perceive more loveliness in their—to us—ugly Venus than in the—to us—beautiful Grecian Venus of Melos. Thus a design may be regarded as beautiful in one country, and hideous in another. There are designs which to us are beautiful and artistic which are blasphemous and ugly to another nation. The canons of Art are very different with different peoples; and perhaps to a less extent with the same peoples trained in different schools of Art. Certain charms in a woman may attract one man and not another; one man marries a drooping eyelid, another a dimpled chin, another a supple waist, and still another a bewitching ankle. The standard of Art or beauty varies with the individual's temperament; it varies with a nation's customs, traditions and habits; and it varies with time, and changes with the prevailing fashion." "When a man claims that 'the public taste wants educating,' I understand him to mean that the public taste differs from his own, and that he would like some missionary work done to try and get their standards in harmony with his own. I deny the right of any man to say that an object beautiful to me is ugly in the abstract, though it may be ugly enough to him. In Art and Politics I am a strong Individualist—*quot homines, tot sententiae*, so many men, so many minds." "Our descriptions of colour are very shocking. A man cannot be frightened as 'white as a ghost,' but his bloodless skin may appear dirty yellow. We say that a girl has sky-blue eyes, when they are really the colour of slate; that she has 'ruby lips' or 'cherry lips,' when they are really the colour of Accrington facing bricks; and that her skin is 'white like the hawthorn buds that open in the month of May' when the real colour is not unlike that of a Swede turnip." H. F. S.

44. Pottery design from the manufacturer's point of view. (Symposium on Art). H. J. PLANT. *Trans. Ceram. Soc.*, **20**, 8–10(1920).—The potter is no powerful enough to sway the nation's fancy. "The most successful designer is he who keeps well in touch, and is ever playing up to the public, following every fickle fancy, and working every craze to his utmost capacity. This requires breadth of conception. The man with fixed ideas is incapable of producing patterns to suit all markets, not that he must be willing to produce designs having no artistic merit, but that his designs must be beautiful in a way that will appeal to the people for whom they are made." "Certain designs produced by a capable man were approved at the Ceramic Society's adjudication last year, but knowing from experience the public taste, another range of samples was made, and both lots put on the market together, with very discouraging results to the adjudicators' approved works. The patterns done to suit the market had a far greater sale than the conventional art designs. The prices of both lots were very similar. The kinds of work very much appreciated throughout the country were borders with naturalistic rose sprays tastily displayed underneath, also roses with narrow brown borders underneath, festoons, scattered flowers, flowers connected by choice bits of ornament, and various other styles suitably colored to meet the present day fancy." H. F. S.

Heavy Clay Products

PATENTS

45. Black tile. TATSUZÔ SHIMOSE. Japan 36,725, July 6, 1920. A mixt. of 60% graphite and 40% fire-proof clay is made to a paste with H_2O, painted on common tile and fired in a kiln to produce fire-proof black tile. (*C. A.*)

46. Material for and process of forming brick, tile, and the like. LLEWELLYN JONES AND CHARLES WESTLAKE, JR. U. S. 1,390,038, Sept. 6, 1921. A material for dry pressing in the formation of brick, tile and the like, containing silica from 65 to 75%, lime from 20 to 30% magnesia from $1^1/_2$ to $3^1/_2$ and sulphur from $1^1/_2$ to $3^1/_2$%.

47. A machine for producing hollow bricks. BROR OSCAR WALTER HESSELMAN AND OSKAR GOTTFRID MEINHARD. Stockholm, Sweden. U. S. 1,386,404, Aug. 2, 1921. In a machine for molding blocks, the combination of a mold, a support, means for moving the mold into operative position at one side of the support and into inoperative position away from the support, means for applying pressure to the material in the mold and means for automatically relieving the pressure when the mold reaches its inoperative position.

48. Brick-kiln construction. JAMES T. POKORNY. U. S. 1,386,530, Aug. 2, 1921. A brick mfg. plant, a fire chamber, drying and firing chambers arranged in superimposed relation above the fire chamber, the floor of the drying chamber having opening therein to admit the heated air circulating about the exterior of the fire chamber, and fuel conducting pipes connecting the firing room with the fire chamber.

49. Apparatus for the manufacture of bricks or building blocks. Edmond Lechat. Nantes, France. U. S. 1,383,131, June 28, 1921. A feeding app. for brick- or building-block presses, comprising in combination upper troughs containing the concrete used to form the main body or core of the brick or block, lower troughs containing the concrete used to form a facing upon one or more sides of the brick or block, endless aprons constituting the movable bottom of the distributing troughs, each trough being provided with adjustable shutters, spouts vertically moved extending through an opening into the mold of the press, a series of feeding chutes leading the first of the qualities of concrete into the spouts and another series of feeding chutes leading the second of the qualities of concrete around the spouts.

50. Building brick. James P. Williams. U. S. 1,385,961, July 26, 1921. A building brick comprising side load-sustaining members, hollow throughout their length to provide longitudinal air-cells; a central load-sustaining member of approx. the same dimensions as the side members and also provided with a longitudinally-extending air-cell; there being at least three of such air-cells in the brick; and solid webs connecting the central load-sustaining member with each of the side members and extending in horizontal planes from the central member approx. midway of its top and bottom portions; the upper and lower faces of each of the side members being in the same plane; the side members being in balanced relation to the central member; the central member presenting two oppositely-disposed hand-holds, whereby the brick is rendered reversible and adapted to be gripped at either side; and there being between the central member a mortar joint-breaking channel having right angularly formed walls.

51. Brick or building block. Jean E. Keifer. Lausanne, Switzerland, U. S. 1,382,652, June 28, 1921. Hollow half bricks or building blocks having sides of equal length and so shaped that when the equal sides are placed together they form a brick or block having at least one face or side shaped as an S with equal limbs.

52. Process of manufacturing and handling brick. Grafton E. Luce. U. S. 1,384,393, July 12, 1921. The process of handling articles during their continuous travel, which consists in moving a carrier against their line of travel, engaging the articles and then retracting the carrier at a speed equal to or greater than the travel of the articles.

53. Revolving crane for brick handling. Grafton E. Luce. U. S. 1,384,768, July 19, 1921. App. of the kind described comprising a rotatably mounted table, a carriage mounted for forward and backward movement thereon, a boom carried by the carriage, a frame suspended from the boom, and links connecting the frame and the carriage to maintain the same parallel to each other.

54. Fire-brick trimming or beveling machine. Frank Wierzbowski. U. S. 1,383,686, July 5, 1921. In a brick-trimming machine of the class described, a carriage adapted to have a grinding or dressing stone clamped therein, means to horizontally reciprocate the carriage, a brick-supporting

pallet, means to elevate the pallet to engage the upper surface of the brick thereon with the stone carried by the carriage, means to adjust the pallet at an angle to the horizontal whereby beveling of the brick may be had, the last named means including a vertically movable standard having a spider fastened upon the upper end thereof, and set screws threaded upward through the spider in supporting engagement with the under surface of the pallet.

C. M. Saeger, Jr.

Glass

55. The relation between the density and chemical composition of glasses. Sa. *Keram. Rundschau*, **29**, 366–67, 390–91(1921).—The d. of glasses may be calc. from their chem. anal. and d. factors as follows:

$$\frac{a}{A} - \frac{b}{B} - \frac{c}{C} - \cdots\cdots\cdots - \frac{n}{N} = \frac{S}{X}$$

a, b, c ..... n are the percents of these constituents in glass, A, B, C ..... N are the factors for the different oxides and X is the d. of the glass. The d. factors are not the same as the d. of the uncombined oxides, this being especially true with Al_2O_3 and Sb_2O_3. The ds. of the same glass may vary 2% according to the method of manuf. In CaO–MgO–SiO_2 glasses the d. factor for MgO is higher while, in Na_2O–MgO–SiO_2 glasses it is lower than the d. of the pure oxide. The true ds. and the d. factors for different oxides in glass are given below:

Oxide	Density		Density Factor in Glass		
			Winkelmann	Tillotson	Baillie
SiO_2	2.22	Deville 1855	2.3	2.3	2.24
Al_2O_3	3.85	Rammelsberg	4.1	2.75	2.75
Sb_2O_3	6.69	...	...	...	3.00
B_2O_3	1.79	Clarke	1.9	2.24	2.90
As_2O_3	3.74	...	4.1	(4.1)	3.33
ZnO	5.65	Schröder	5.9	5.9	5.94
BaO	5.00	Clarke	7.0	7.0	7.20
CaO	3.30	Moissan	3 3	4.1	4.30
MgO	3.60	Clarke & Moissan	3.8	4.0	3.25
PbO	9.30	Clarke	9.6	9.6	10.30
K_2O	2.66	...	2.8	(2.8)	3.20
Na_2O	2.55	...	2.6	2.8	3.20

H. G. Schurecht

56. Progress in manufacturing radio-protective glasses. W. W. Coblentz. *Optician*, **58**, 265(1920); *J. Soc. Glass Tech.*, **4**, 27.

H. G. (*C. A.*)

57. Synthetic helium and neon. A. Lo Surdo. *Atti accad. Lincei* [v], **30**, i, 85–88(1921).—L. finds that Ne, He, and H are able to pass through *hot glass*, the H in far greater quantity than the other two gases. The passage is dependent on the temp., nature, and thickness of the glass. These results may furnish an explanation for the origin of so-called synthetic He and Ne, which may be derived from the atm. J. C. S. (*C. A.*)

58. Electric load conditions in the glass industry. C. W. Fick. *Gen. Elec. Rev.*, **24**, 539–42(1921); illus.—Includes a brief account of modern plate-glass manuf. C. G. F. (*C. A.*)

59. **Nomenclature of glass.** C. J. PEDDLE. *J. Soc. Glass Tech.*, **17**, 3–15(1921).—*A plea for standardization* international if possible, of glass nomenclature. At present there is much confusion because of overlapping of trade names and technical terminology. A *set of rules is suggested* for a standard nomenclature which specifies the constituents. In the case of optical glass it is suggested that the main classes be subdivided according to the refractive index for the D lines instead of according to d.

W. C. TAYLOR

60. **Comparison of the alkali-lime-silica and the alkali-lead oxide-silica glasses.** Part X of "The Development of Various Types of Glass." C. J. PEDDLE. *J. Soc. Glass Tech.*, **17**, 72–106(1921).—Several series of glasses were prepared and studied containing (1) 20 or 40 mol. of Na_2O or K_2O and 5 to 40 mol. of CaO or PbO or a mixt. of the two, to 100 mol. of SiO_2, and (2) 10 to 25 percent of Na_2O or K_2O and 5 to 20 percent of CaO or 5 to 30 percent of PbO and 60 to 70 percent of SiO_2. The *density and total dispersion* are higher for lead than for the corresponding lime glasses of corresponding mol. or percentage compns. and the *refractive index* is higher in lead glasses of the same mol. compn., but not as high as lime glasses of the same percentage compn. except when the SiO_2 content is under 60 percent and at the same time the alkali content greater than 20 percent. Also the lead glasses show a relatively greater dispersion toward the blue end as compared with the red end than corresponding lime glasses. Lime glasses are more prone to *devitrification* than lead glasses, particularly if they contain soda, but their *soly.* is less weight for weight and also when compared molecularly unless the alkali content is under 15 percent. For lime and particularly for lead glasses with an alkali content less than 20 percent, glasses containing equal weights of Na_2O and K_2O are less sol. than corresponding glasses containing only one alkali. The *weathering* results are very similar to those for soly.

W. C. TAYLOR

61. **Influence of aluminum on the working properties of glass.** VIOLET DIMBLEBY, F. W. HODKIN AND W. E. S. TURNER. *J. Soc. Glass Tech.*, **17**, 107–115(1921).—Two series of glasses were prepared, (1) $6SiO_2$, xNa_2O, yAl_2O_3 where $x+y=2$, and (2) $6SiO_2$, $1.1Na_2O$, $xCaO$, yAl_2O_3 where $x+y=0.9$. With temp. of 1400–1425°C the authors were unable to melt and plane a glass containing above 13 percent Al_2O_3 in the first series and 7.5 percent Al_2O_3 in the second; yet in the latter series small amts. of Al_2O_3 rendered the soda-lime glass more readily fusible. In the first series, increasing the alumina rapidly increases the *viscosity and toughness* and its tendency to acquire a hard skin on marvering. But alumina was found very favorable to easy *manipulation in lamp working* and also of value in preventing *devitrification*. The *thermal conductivity* seemed to decrease as the alumina content increased.

W. C. TAYLOR

62. **Effect of aluminum on the annealing temperature of glass.** S. ENGLISH AND W. E. S. TURNER. *J. Soc. Glass Tech.*, **17**, 115–18(1921).—The annealing temp. was determined by the optical method for the two

series of glasses described in the preceding abstract, with the conclusion that *when replacing magnesium or calcium* mol. for mol. and also g. for g., aluminum reduces the annealing temp. in most cases. G. S. FULCHER

63. Some optical properties of the sodium-aluminium tri-silicate glasses. J. R. CLARKE AND W. E. S. TURNER. *J. Soc. Glass Tech.*, **17**, 119–20(1921). —Data are given for the *refractive index and dispersion* of four glasses with the compn. $6SiO_2$, xNa_2O, yAl_2O_3 where $x+y=2$ and the alumina was varied up to 9 percent. The index increases with the d. but not so fast, whereas the dispersion increases faster. G. S. FULCHER

64. Effect of sodium oxide on the thermal expansion of sodium silicate glasses. S. ENGLISH AND W. E. S. TURNER. *J. Soc. Glass Tech.*, **17**, 121–23. (1921).—The *expansion* coeff. for seven sodium silicate glasses with silica content of from 67 to 83 per cent were detd. The results correspond to the equation: $\alpha \times 10^3 = 5.0 + 4.20N - .0002N^3$ where N is the percent Na_2O. Taking the factor for 1 percent silica as 0.05×10^{-6}, the factor for Na_2O is 4.25×10^{-6}. For cubical expansion the corresponding factors come out 0.15 and 12.75 instead of 0.8 and 10.0 as given by Schott. The value for Na_2O agrees well with that previously obtained from sodium-calcium glasses, 12.96. G. S. FULCHER

PATENTS

65. Drawing and painting glass. ANSON K. CROSS. U. S. 1,387,439, Aug. 9, 1921. A painting corrector comprising a spirit level and means for producing side by side two blurred images, one of the subject and the other of its representation, and a frame in which the elements are so mounted that the spirit level indicates the correct leveling of both the frame and the image-producing means.

66. Automobile-headlight glass. WILLIAM G. SCHNEIDER. U. S. 1,391,511, Sept. 20, 1921. A headlight glass of the character described, comprising a glass plate having series of undulations over the entire surface of one side thereof, and having outwardly rounded, raised portions forming a spotted arrangement over the entire surface of the opposite side, the cross sectional width of the undulations being greater than the cross sectional width of the rounded raised portions, and the border of the glass being of less translucent character than the central portion of the glass.

67. Lens-cutting machine. WALTER W. SLADE. U. S. 1,388,774, Aug. 23, 1921. A lens-cutting machine of the kind described, comprising a swinging support for the cutter, adapted to be held under spring tension toward the work to be operated on, and a lever operable to move the work holder out of operative position.

68. Abrasive for grinding and smoothing glass. WILLIAM L. KANN. U. S. 1,387,649, Aug. 16, 1921. The method of grinding, smoothing and finishing glass preparatory to polishing, comprising supplying to the glass a natural cryst. abrasive of such character that as it is crushed and broken the

smaller grains and particles thereby produced are of distinct cryst. form, and continuously collecting and supplying to the glass such abrasive during the grinding, smoothing and finishing operations.

69. **Glass-discharging mechanism.** EDWARD S. HUTTON. U. S. 1,391,957, Sept. 27, 1921. Discharge means for a glass tank, including a discharge member adapted to extend through the wall of the glass tank and beyond the inner and outer surfaces thereof and having a glass conduit leading from the bottom of the inner end of the member upward and thence horizontally to the outer end of the member and thence upward to a point slightly above the normal level of the glass in the tank and thence downward to the discharge outlet, and an air conduit leading from the outer end of the member horizontally to the inner portion of the glass conduit and means for introducing air under pressure in the air conduit.

70. **Sheet-glass-drawing machine.** CLARENCE A. RHONEMUS. U. S. 1,391,405, Sept. 20, 1921. In a sheet-glass drawing mechanism, the combination of a pot containing a mass of molten glass and having oppositely-disposed discharge portions below the glass level, and vertically moving, longitudinally-slotted tubes having transverse openings therein, with transverse glass scoring mechanism entering the opening, and logitudinal glass scoring devices.

71. **Sheet-glass-drawing apparatus.** CLARENCE A. RHONEMUS. U. S. 1,391,406, Sept. 20, 1921. In a sheet-drawing app., a receptacle for molten glass from which the sheet is drawn, a cooler for the sheet adjacent the drawing point, gaseous heating means above the molten glass for heating the surface glass, and a shield between the heating means and the glass, transmitting the heat downward therethrough, but preventing direct contact of the hot glass with the cooler.

72. **Method of making bifocal lenses.** HENRY A. SCHEUERLE. U. S. 1,383,863, July 5, 1921. The method of making bifocal lenses which consists in rotating the blank to be abraded, with the minor area at the axial region thereof and the major area at the distal region thereof, while rotating abrading means contiguous to the major area in an annulus encircling the axis of rotation of the blank but eccentric to that axis; and preventing any change in the direction of the respective axes during the abrading operation; and thereby preventing abrasion of the axial, minor region of the blank while circularly abrading an annular, major region of the blank concentric with the axis of rotation of the blank but eccentric to the axis of rotation of the abrading means.

73. **Frosted glass and process for making same.** CHARLES F. LORENZ. U. S. 1,386,880, Aug. 9, 1921. The process of finishing a glass surface which consists in sand-blasting the glass surface and afterward rubbing the surface with an abrasive.

74. **Apparatus for drawing sheet-glass.** THOMAS S. OWENS. U. S. 1,386,-724, Aug. 9, 1921. In a continuous sheet-glass drawing app., two sheet drawing units disposed in opposite relation at opposite sides of a sheet being drawn, each of the units comprising shafts transversely spaced longitudinally

of the sheet, sprocket wheels carried by each shaft, a pair of sprocket chains connecting the wheels and spaced longitudinally of the shafts, and sheet engaging bars connecting the chains and spaced longitudinally thereof to provide a considerable space between the points of engagement of a sheet by the bars, the bars of one unit coöperating with those of the other unit to grip and impart drawing movements to the engaged sheet, the bars of the separate units also coöperating to score and weaken the engaged sheet at the points of gripping of the same.

75. Means and method for producing charges of molten glass. CLYDE R. LOTT. U. S. 1,382,993, June 28, 1921. The method of feeding molten glass, which consists in intermittently delivering from a tank to a container exterior thereto, predetermiued quantities of molten glass, causing the same to be intermittently discharged downward from the container through an outlet orifice and subjecting the discharged glass to the action of a mech. shearing means spaced below the oriface whereby mold charges are formed.

76. Production of bores in glass. JOSEPH KENT. Maldon, England. U. S. 1,382,650, June 28, 1921. The method of manuf. glass tubing, which consists in iucorporating with a mass of glass a sealed length of glass tubing, and thereafter drawing out the piece thus constituted until it is reduced to the required cross sectional dimensions.

77. Apparatus for sawing glass. WILLIAM TAYLOR. England. U. S. 1,385,731, July 26, 1921. App. for sawing glass, which comprises in combination a saw, a work holder for supporting the glass to be sawed, means by which one of the members tends to move to cause a relative approaching movement between the glass and the saw with a force sufficient to effect the approaching movement at the desired rate when the saw is in proper working condition but not sufficient to damage the saw or the glass when the saw is blunt, and means for limiting such approaching movement to a predetermined rate slightly less than that which would normally overload the saw.

78. Machine for making glass bottles. CHARLES F. COX. U. S. 1,385,428, July 26, 1921. In a bottle-making machine, an inverted mold for receiving the molten glass, shears above the mold for removing the excess glass, a downwardly movable plunger provided with a bottom finishing head, means for operating the shears, and means controlled by the shear operating means for both operating the plunger and rotating the neck-finishing head.

79. Mechanism for shifting plate-glass and grinding tables. FRANK E. TROUTMAN. U. S. 1,385,852, July 26, 1921. In app. for shifting plate-glass grinding tables, the combination of a suitable track, a grinding table, wheels on the table adapted to engage the track, means for disengaging the wheels from the track, a high-power elec. motor, a shaft driven thereby at relatively high speed, connections between the shaft and the table for rotating the same, a low power elec. motor, a shaft driven thereby at relatively low speed, and a magnetic clutch between the first-named shaft and the last-named shaft, the clutch being energized when the low power motor is started, whereby, when the low-power motor is put into operation, the magnetic

clutch is automatically operated to connect the shafts when the first-named motor is idle.

80. Glass pavement-light. FREDERICK L. KEPPLER. U. S. 1,385,688, July 26, 1921. As a new article of manuf., a tile unit comprising a glass body with a substantially flat upper surface, a depending rim about its edge, a plurality of projections from the lower surface of the tile, within the rim, shaped to form strengthening and light diffusing areas, and a series of abrasive plugs set in the upper surface of the tile above the projections, each plug lying well within the boundary of the projections over which it is placed.

81. Apparatus for grinding and polishing plate-glass. FRANK EDWIN SLOCOMBE: England. U. S. 1,384,278, July 12, 1921. In a sucker device, adapted to hold glass on to a grinding or polishing table the combination with a sucker movable relatively to the table and to which the glass is attached by atmospheric pressure, of pneumatic means operatively connected to the sucker for allowing the glass to be pressed against the table by atmospheric pressure, the relative areas of the glass and pneumatic means which are subjected to the said pressure being such that, of the total atmospheric pressure on the glass due to whatever degree of vacuum there may be in the sucker device, a portion determined by the dimensions of the latter operates to press the glass on to the table while the remainder presses the glass on to the sucker.

82. Apparatus for the manufacture of glassware. WILLIAM H. MCSWAIN. U. S. 1,384,967, July 19, 1921. An app. for the manuf. of pressed articles of glassware, comprising a platform, an endless carrier arranged for continuous travel over the platform, a plurality of molds borne by the carrier at regular intervals, a press disposed over the path of travel of the molds, the press being arranged to advance successively with the molds throughout a definite distance, means actuated during forward travel of the press for reciprocating the plunger of the latter with respect to an underlying mold for shaping the ware, and a glazing oven through which the molds travel following the ware-shaping operation.

83. Glass-tank furnace. JOSEPH E. HURLEY. U. S. 1,390,614, Sept. 13, 1921. A glass-tank furnace, comprising tanks forming the walls thereof, means for supplying water to the tanks, a fibrous facing on the inner walls of the tank, and a passage formed between the walls of the tank and the facing, the passage communicating with the tank.

84. Glassware-machine. EDMA H. CURTIS, JR. U. S. 1,386,240, Aug. 2, 1921. In a leer, the combination with interspaced fixed and movable supports for glassware in the leer, and a conveyer member having fixed supports corresponding to the fixed supports of the leer, of a driving member common to the movable supports and the conveyer, and adapted to move the movable supports to unload the conveyer member and to move the conveyer member into and out of the leer, the driving member timed to thrust forward the movable supports after the conveyer member is in place in the leer, then lift the supports, then withdraw the supports, and then move the conveyer member out of the leer.

85. Apparatus for drawing glass cylinders. ARTHUR E. SPINASSE. U. S. 1,386,441, Aug. 2, 1921. In an app. for drawing glass cylinders, a furnace, a forehearth extending from the furnace, a wall between the two, a recess in the wall and cooling means in the recess, a cover for the forehearth having an opening therein, a ring in the opening, a support for the ring, the support extending under the ring, means for raising and lowering the support and ring, and a glass segregating element adapted to float in the glass in the forehearth and to rise into contact with the ring support without adhesion.

86. Glass construction unit. FREDERICK L. KEPPLER. U. S. 1,386,409, Aug. 2, 1921. A new article of manuf. A glass tile comprising a relatively thin portion, downwardly depending edges having corrugated outer surfaces, a band of cement material let into the corrugations, the outer surface of the band being channeled. C. M. SAEGER, JR.

See also No. 24.

Cement, Lime and Plaster

87. Transformation of light magnesia into the dense form. N. PARRAVANO AND C. MAZZETTI. *Atti accad. Lincei*, **30**, i, 63–66(1921).—The results of the authors' expts. show that the velocity of hydration of MgO diminishes as the temp. and duration of its previous calcination are increased, no discontinuity being observable. The statement that MgO undergoes transformation at about 1600° (Le Chatelier, *Le Chauffage*, 399) or 1100° (Campbell, *C. A.*, **12**, 268) is inaccurate, this change having already begun at the lowest temp. employed by the authors, namely 800°, at which, however, it proceeds very slowly. This result is confirmed by Ditte's measurements of the d. of the oxide after being heated at definite temps. for a certain time (*J. Chem. Soc.*, **24**, 869(1871)). Natural magnesites contain impurities which exert a marked influence on the velocity of hydration of the oxide resulting from their calcination, the transformation into the dense modification being facilitated. This change is at first slow and continually increases in rapidity as the temp. is raised, and no definite transformation temp. probably exists.

J. C. S. (*C. A.*)

88. Special ferriferous agglomerate and its applications in presence of pozzuolanous substances. FABIO FERRARI. *Giorn. chim. ind. applicata*, **3**, 53–56(1921).—The ferriferous agglomerate had the following compn.: SiO_2 = 24.04%, insol. siliceous residue = 0.28, Al_2O_3 = 3.32, Fe_2O_3 = 5.24, CaO = 65.10, MgO = 0.47, SO_3 = 0.61, alkali (not detd.) = 0.94. F. drew the following conclusions from this study: (1) Cements of this type, in which the sesquioxides stand in equiv. relations, are free from binary combinations of these sesquioxides. They are, therefore, stable towards the action of sulphates and chlorides. Since the greatest fusibility of the material forming the second consolidation of the clinkers corresponds to the existence of the above mentioned equiv. proportions, the above type of cements may be regarded as products showing the easiest scorification and containing the greatest amounts of hydraulics (Ca silicates). They may, therefore, be substituted in all

applications, not only of ferroportlands, but also of ordinary Portlands. (2) Pozzuolanous substances added to the above type of cements moderate their high basicity and fit them for mortars of the highest permeability. These mixts. also possess a mechanical resistance greater than mortars of ordinary Portlands in general use. ROBERT S. POSMONTIER (*C. A.*)

89. **Electrified cement industry.** LLOYD W. CHAPMAN. *J. Elec. Western Ind.*, **47**, 7–9(1921).—The method of manuf. Portland cement at the Santa Cruz Portland Cement Co. is briefly described with 5 illustrations. About 60% of the K_2O that enters the plant is recovered. The product contains about 33% K_2O, is completely sol. in water and is very suitable for fertilizers, being free from any injurious impurities. The K is recovered from the dust by a Cottrell precipitator. C. G. F. (*C. A.*)

90. **Law governing the hardening of cement.** J. BIED AND E. GARNIER. *Rev. ing. index tech.*, **28**, 269–72(1921).—The tensile strength of cement after 84 days can be calcd. from the strengths at 7 and 28 days from the formula $R_{84} = K(2R_{28} - R_7)$ where K is a const. which is very near 1 for all except quick-setting cements. Hence the hardening equation is hyperbolic and is $(t-3.6)(h-2.7)=152$ for cements and $(t-8.5)(h-8.7)=429$ for limes, where t is the time (the meaning of h is not given). Calcd. and detd. values are given for 2 samples and show very close agreement. A. P.-C. (*C. A.*)

91. **The physical properties of magnesia cement and magnesia cement compounds.** R. J. ROARK. *Bull. Univ. Wis. Eng. Series*, **8**, No. 5, 257–331 (1917); *Expt. Sta. Record* **43**, 282.—This bulletin presents the results of an exptl. study of the physical properties of magnesia cement and magnesia cement compds. and of the factors affecting these properties. An important object of the investigation was the detn. of physical tests which could be relied upon to indicate the suitability or unsuitability of particular cements or compds. for use as flooring material. A description of magnesia cement, its manuf. and uses, is given, together with a summary of the results of chem. investigations. H. G. (*C. A.*)

92. **Lime kilns and lime burning.** RICHARD K. MEADE. *Sugar*, **23**, 264–66 (1921).—The various types of lime kilns are described. A water-jacketed cooling cone gives longer service. Reinforced concrete was used to replace the steel jacket for the kiln with excellent results. Relative values of fuels are summarized: one ton bituminous coal hand-fired 3.5–4 tons lime; one ton coal fired as producer gas burns 3.5–5 tons lime; 1 bbl. oil fires 1–1.75 tons lime; 1 cord wood fires 2.25–2.75 tons lime. C. H CHRISTMAN (*C. A.*)

93. **The equilibrium between Portland cement and limewater.** RICHARD LORENZ & GUSTAV HAEGERMANN. *Z. anorg. allgem. Chem.*, **118**, 193(1921).—The material for expt. was prepd. by mixing with 12% H_2O, and compressing and ageing 28 days over H_2O and 7 days in a desiccator. It was then ground and screened through 180 and 220 mesh sieves and again stored over H_2O for two months. Samples of 0.5 to 4 grm. were stirred rapidly into 500 cc. H_2O in a Jena flask kept at constant temp. and stirred continuously. CaO was detd. in the filtrate. The rate of soln. of CaO increased regularly with

fineness and with temp. but irregularly with time. The first rapid soln. was followed by a period in which the CaO in soln. was constant: then the amt. of CaO in soln. increased asymptotically to a constant value. The same shape of curve was obtained repeatedly by treating with fresh portions of H_2O as long as any of the original clinker remained. The final insol. portion after all CaO had been leached out was gelatinous $SiO_2 + Al_2O_3$. The expt. data are interpretive as follows; First CaO is dissolved leaving $SiO_2 + Al_2O_3$. When the $Ca(OH)_2$ in soln. reaches a certain concn. it is adsorbed by the colloidal $SiO_2+Al_2O_3$ during which period the $Ca(OH)_2$ in soln. remains const. When the gel is "saturated" the concn. of $Ca(OH)_2$ again increases. By repeating the treatment with fresh portions of H_2O until no clinker remained the distribution coeff., $\frac{\text{CaO adsorbed}}{\text{CaO in solution}}$ was found to approach a value of about 7. The author considers that these findings have an important bearing on the use of cement in contact with ground waters, sea waters, etc.

E. W. T.

PATENTS

94. Magnesia plaster. Shôzaburô Mimura and Rokusaburô Yamamoto. Japan 36,733, July 8, 1920. Lower coating: A mixt. of 5% saw dust, 10% asbestos and 40% MgO is made to a paste with 44% $MgCl_2$ in 2–3% Pb acetate soln. Upper coating: A mixt. of 40% MgO, 5% powdered peanut husks, 10% asbestos and 5% pigment is made to a paste by the same $MgCl_2$ soln. in Pb acetate soln. The plaster is antiseptic and odorless. (*C. A.*)

95. Plastic composition for bricks. John Smith. U. S. 1,385,757, July 26, 1921. A plastic compn. comprising cement, coal ashes and brick dust of substantially equal proportions. C. M. Saeger, Jr.

BOOK REVIEWS

A discussion of the making of reflecting surfaces. Held on Nov. 26, 1920 at the Imperial College of Science and Technology, South Kensington, S. W. 7, England. Price 5s. 6d. sent to The Optical Society at the above address. This booklet is a collection of the following papers ending with a general discussion. 1. Survey of the Bibliography of Metallic Deposition on Glass. By R. Kanthack. 2. A Bibliography of the more important Papers on the Construction and Nature of Reflecting Surfaces. By R. Kanthack. 3. Notes on the Formaldehyde Process of Silvering. By H. N. Irving. 4. Some Workshop Notes on Silvering. By James Weir French, D.Sc. (Messrs. Barr & Stroud, Ltd., Glasgow). 5. The Silvering of Glass Reflectors by Chemical Deposition. By F. Ellerman and H. D. Babcock (Mount Wilson Observatory). 6. The Silvering of a Large Reflector. By C. R. Davidson (Royal Observatory). 7. Note on the Silvering of Quartz and Glass Fibres. By R. S. Whipple, M. I. E. E. (The Cambridge and Paul Instrument Co., Ltd.). 8. Some Notes on Mirrors Used for Reflecting Heat Radiation. By Prof. Chas. Féry (École Municipale de Physique et de Chimie, Paris). 9.

Deposition of Metals by Cathodic Spluttering in Vacuo By F. Ellerman and H. D. Babcock (Mount Wilson Observatory). 10. Note on the Production of Mirrors by Cathodic Bombardment. By F. Simeon, B.Sc., F. Inst. P. (Messrs. Adam Hilger, Ltd.). 11. Platinum Reflecting Surfaces Prepared by the "Burning-in" Process. By Julius Rheinberg, F. R. M. S., F. R. P. S. 12. A Note on Mirrors for use in Optical Instruments under Industrial Conditions By W. G. Collins (The Cambridge and Paul Instrument Co. Ltd.). 13. A Photometric Method of Measuring the Reflecting Power of Mirrors. By John W. T. Walsh, M.A., M.Sc. (The National Physical Laboratory). 14. General Discussion.

Vol. 1 FEBRUARY, 1922 No. 2

Ceramic Abstracts

Edward W. Washburn, Editor
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Abstractors: E. N. Bunting, W. M. Clark, G. S. Fulcher, S. L. Galpin, Seiji Kondo, A. T. Malm, R. J. Montgomery, Louis Navias, C. W. Parmelee, C. M. Saeger, Jr., H. G. Schurecht, R. B. Sosman, H. F. Staley, E. W. Tillotson.

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General and Miscellaneous

1. The utilization of red slime. OSKAR LECHER. *Tonind. Ztg.*, **45**, 1023(1921).—In the manuf. of $Al(OH)_3$, bauxite is mixed with a soln. of NaOH and heated to 160–170°C in an autoclave under a pressure of 3–4 atms. or is fused with soda. In each case an easily sol. $Na_3Al_2O_3$ is formed which is removed by filtration. A red slime containing Fe_2O_3, SiO_2, TiO_2 and MgO remains in the filter press and is very abundant as a by-product. In one case this slime had the following compn.: H_2O 7.8%, loss on ignit. 12.3%, SiO_2 11.0%, Fe_2O_3 50.9%, CaO 8.2%, MgO tr. and TiO_2 0.23%. This material has been successfully substituted for Fe_2O_3 as a coloring oxide in glazes. By using the following mixt. a beautiful light green was obtained: 75.5 flint, 21 $CaCO_3$ and 0.7 red slime. By using 1.4 grs. of slime a dark green was obtained. With increasing amts. browns were obtained. By adding varying amts. of this slime to light burning clays many shades of red ware may be produced.

H. G. SCHURECHT

2. Poured molds versus pressed molds. ANON. *Tonind. Ztg.*, **45**, 982–83 (1921).—Plaster molds made under pressure are much stronger and more durable than those made by casting. Pressed molds are more suitable for molding tough bodies and where considerable pressure is used in molding, while the cast molds are more suitable for casting clay wares. H. G. S.

3. The proper lubrication of ball bearings. H. BURRIE. Société des Roulements á Billes SKF. *Industrie chimique*, **8**, 276–77(1921).—The function of lubrication in ball bearings is the protection against corrosion and facilitating the longitudinal motion of the journal when such is required. The lubricant must be free from acids and alkalies (max. 0.1%), lime (max. 0.5%), resins, and all traces of impurities which might cause friction. The best lubricant is a high grade oil of suitable viscosity (depending on the nature of the work). If grease is used it must not melt at the temp. of the bearing. Graphite should never be used for lubricating ball bearings. Simple tests for detecting acidity, alkalinity, and resins, and for detg. m. p. are given. A. P.-C.(*C. A.*)

4. Dental ceramics: a treatise on the technic of porcelain manipulation. FRED R. FELCHER. *Dental Cosmos*, **63**, 387–94, 483–88, 624–32, 681–87(1921).—A comprehensive survey of the entire field. JOSEPH S. HEPBURN (*C. A.*)

5. Internal friction of liquids under high pressure. O. FAUST. (Cf. *C. A.*, **8**, 1373).—The detn. of the compressibility of lubricating oils under high pressure, and the application of the results to the tests of a high-pressure viscosimeter to obtain the values of the viscosities of the oils. J. H. HYDE. The detn. of certain physical properties of the oils used in the Lanchester worm gear experiments. ANON. Testing the viscosity of oil at high pressure. CHARLES A. PARSONS. Variation in the efficiency of a worm gear due to the differences in the lubricant employed. J. H. HYDE. An app. for the detn. of the absolute viscosities of liquids at high pressures and the results obtained with it for certain lubricating oils. J. H. HYDE. App. for the examn. of the viscosity of oils under any pressure. C. V. BOYS. Description of the oil-testing app. designed by R. M. Deeley. ANON. (Cf. *C. A.*, **14**, 1475.) Précis of report

by T. C. Thomsen on the cup-and-ball viscosimeter designed by Michell. ANON. Report on tests made in the Lanchester worm gear testing machine on three samples of aircraft oils. J. H. HYDE. Rept. on the characteristics of the flow of oil over a journal bearing. J. H. HYDE. Memorandum on J. H. Patterson's suggested method for preventing the sepn. of oil emulsions when mixed with salt water. ANON. Results of examn. of a sample of "Aliphol Omnium" compounding medium for lubricating oils. ANON. Trials of "Oildag" in aero engines by the Air Ministry. D. R. PYE. Detn. of the frictional coeff. of shaft bearings (plummer blocks) using a lubricant with and without the addition of "Oildag." EUGENE C. BINGHAM (*C. A.*)

6. The improvement of the lubricating properties of mineral oils. J. H. HYDE. *Engineering*, **111**, 708–709(1921).—Tests made on the Deeley friction testing machine (cf. preceding abstract) and the Lanchester worm gear machine (cf. *C. A.*, **14**, 1475) prove that, on adding oleic and other organic acids to a mineral oil, a very considerable reduction in the static friction is produced. So little as 0.1% of fatty acid effects a very considerable reduction; oleic acid, acid rape oil and the rape oil fatty acids all having similar effect. The Lanchester machine shows a gear efficiency of 96.0% with straight mineral oil; on adding 0.2% of oleic acid the efficiency is raised to 96.4%.

EUGENE C. BINGHAM (*C. A.*)

7. Human waste in industry. HARRY E. MOCK. *Chem. Met. Eng.*, **25**, 369–74(1921).—A symposium. (*C. A.*)

8. Industrial benefits of research. CHARLES L. REESE AND A. J. WADHAMS. *Nat. Research Council, Reprint Circ. Series*, **18**, 13 pp.(1921).

E. H. (*C. A.*)

BOOKS

9. Les Colloides: Leurs gelées et leurs solutions. P. BARY. Paris D. 47 and 49 Grands Augustins. 508 pp. 50 fr. For review see *Rev. prod. chim.*, **24**, 538 (1921). (*C. A.*)

10. Report of the lubricants and lubrication inquiry committee. *Dept. of Scientific and Industrial Research. Advisory Council. H. M. Stationery Office*, 1920, 126 pp. S. DONKIN, Chairman. The report reviews existing knowledge of lubrication and suggests several lines along which research is needed. The following appendices are part of the report. Internal friction of liquids under high pressure. O. FAUST. (Cf. *C. A.*, **8**, 1373). The detn. of the compressibility of lubricating oils under high pressures, and the application of the results to the tests in the high-pressure viscosimeter to obtain the values of the viscosities of the oils. J. H. HYDE. The detn. of certain physical properties of the oils used in the Lanchester worm gear experiments. ANON. Testing the viscosity of oil at high pressure. CHARLES A. PARSONS. Variation in the efficiency of a worm gear due to the differences in the lubricant employed. J. H. HYDE. An app. for the detn. of the absolute viscosities of liquids at high pressures and the results obtained with it for certain lubricating oils. J. H. HYDE. Description of oil-testing app. designed by R. M. Deeley. ANON. (Cf. *C. A.*, **14**, 1475.) Précis of report by T. C. Thomsen

on the cup-and-ball viscosimeter designed by Michell. ANON. Report on tests made in the Lanchester worm gear testing machine on three samples of aircraft oils. J. H. HYDE. Rept. on the characteristics of the flow of oil over a journal bearing. J. H. HYDE. Memorandum on J. H. Patterson's suggested method for preventing the sepn. of oil emulsions when mixed with salt water. ANON. Results of examn. of a sample of "Aliphol Omnium" compounding medium for lubricating oils. ANON. Trials of "Oildag" in aero engines by the Air Ministry. D. R. PYE. Detn. of the frictional coeff. of shaft bearings (plummer blocks) using a lubricant with and without the addition of "Oildag."

EUGENE C. BINGHAM (*C. A.*)

Apparatus and Instruments

11. Modern filtering apparatus. HERMANN RABE. Charlottenburg. *Chem. Ztg.*, **45**, 501–504, 532–34(1921).—Brief descriptions, with 14 cuts, of the Kelly and Sweetland filter-presses, of the de Häen, Plausen and Passburg ultra-filters, of vacuum filters, hydraulic presses, Heine centrifugals, sand filters, filters with air pressure, and the special H_2O-purification Berkefeld and Hansa filters. J. H. MOORE (*C. A.*)

12. Study of the fundamental laws of filtration using plant-scale equipment. FRED P. BAKER. *J. Ind. Eng. Chem.*, **13**, 610–12(1921).—Theory, derivation and practical application of W. K. Lewis' fundamental filter equation are discussed. Tests were made on com. filter presses to study the filter equation and to det. consts. for defecated sugar solns. The use of the equation in designing filters is shown. For sludges containing compressible solids a constant rate of flow through filter is markedly superior to operation under const. pressure. A. R. ALBOUZE (*C. A.*)

13. Viscosimeters. F. WILBUR SHULENBERGER. *Paint, Oil, Chem. Rev.*, **72**, No. 3, 10–11, 13–14(1921).—There is a general discussion of the measurement of viscosity and a brief description of the following types of viscosimeters:—Scott, Engler, Redwood, Saybolt Universal, Saybolt Furol, Gardner and Holdt Bubble, Stormer, and Doolittle.

EUGENE C. BINGHAM (*C. A.*)

14. Constant-temperature baths. "OMEGA." *Chem. Trade J.*, **69**, 30 (1921).—A list is given of 15 mixts. for const.-temp. baths and requiring little attention for boiling temps. from 40° to 300°. For the lowest temp. a mixt. of 98% EtBr and 2% EtOH is used and for the highest temp. 90% cottonseed oil and 10% beeswax. W. H. BOYNTON (*C. A.*)

15. The pyrometer from the standpoint of the user. ARTHUR N. ARMITAGE. *Trans. Am. Soc. Steel Treat.*, **1**, 651–53(1921).—Practical suggestions of construction, standardization and operation. An elec. weld gives better results than an acetylene weld for couples. Dry fire clay in the protecting tubes increases the life of iron-constantan couples. W. A. MUDGE (*C. A.*)

16. A new centrifugal filter press. C. R. PLATZMANN. *Tonind. Ztg.*, **45**, 1081–82(1921).—A new centrifugal filter press made by Stancourt Sons and Muir Ltd., Lon. is described. The substance to be filtered is thrown with

great force against a filtering medium with a pressure as high as 1 kg./cm.^{2}. When filled the machine is stopped and the clay is easily removed by raising the outer shell of the press. H. G. SCHURECHT

17. Sandwasher. L. SCHMIDT. *Tonind. Ztg.*, **45**, 1047–48(1921).—The Bavaria Machine Co., Schwaben, make a sand washer in the form of a hexagonal rotary screen. The sand is fed in at one end while water forced in at the other washes the impurities thru the screen. Sands containing as high as 60% clay may be thus washed. The washer occupies little space and can therefore be operated indoors. H. G. SCHURECHT

18. Carbon dioxide indicator of simple design and rugged construction. ANON. *Elec. Rev.* (Chicago), **79**, 218(1921).—The instrument worked by a minute jet of steam continuously aspirates gases from the flue to which it is connected. The gas drawn through an Al filter passes into a chamber of the indicator with a porous pot inside contg. a dry reagent. A pipe connects the chamber with a vessel contg. water into which dips one end of a second pipe, the other end of which is taken into the porous pot. Some gas penetrates into the interior of this pot and is absorbed by the reagent, causing partial vacuum and the colored liquor rises in the glass tube calibrated in percentages of CO_2, which may be read at considerable distance. Renewal cartridges inserted once in 24 hrs. maintain the instrument in continuous operating condition. L. C. KRUEGER (*C. A.*)

19. Methods for measuring large volumes of gas, especially applicable to gas plants or coke ovens. C. BERTHELOT. *Rev. metal.*, **17**, 668–76(1920).—B. describes briefly, giving advantages and disadvantages, the methods for measurement by means of a gasometer, by the Pitot tube, by the Lecocq method which is based upon the detn. of the exact vol. of air admitted to the furnace for combustion of the gas, of the vol. of gas drawn out by the exhauster, of the NH_3 in the gas and in the wash water, and at some length, the Murgue method which is based upon the measurement of the loss in pressure caused by a diaphragm inserted in the gas main, the difference in pressure on the opposite sides of the diaphragm being measured by a manometer. The app. is very exact, measuring variations within 0.01 mm. J. L. WILEY (*C. A.*)

20. Mill for colloidal comminution in industrial chemical work. C. NASKE. *Z. Ver. deut. Ing.*, **65**, 495–96(1921); cf. *C. A.* **15**, 1584.—The characteristics and importance of org. colloids as regards plant nutrition, and of inorg. colloids as regards *ceramics*, colors, photography, etc., are discussed. Methods of prepg. dispersions may be either by elec. or mechanical means. A hammer mill has the disadvantages that an increase in speed increases the air resistance; much heat is evolved to no purpose; and the finest particles, which should be further subdivided, escape the beaters and are carried through the gratings with the air stream. A ball mill has the disadvantages that the velocity of fall of the balls is small, the work done per blow small and the number of blows few. Hence, an impractical length of time is required for colloidal comminution. Plauson's "Colloidmill" first made possible the mechanical prepn. of dispersoids on a large scale by modifying a hammer mill so that the beater arms impinged

on a liquid surface. P. further operated the rotor at very high peripheral speed to increase the number of blows per unit of time. Two cross-sections of the mill are shown. It consists of a water-cooled cylindrical casing with axis horizontal, and on eccentrically mounted rotor whose projections work past similar projections fixed on the casing and on an adjustable bottom bed plate. When the rotor is operated at high speed the liquid is flung off the rotor and again sucked in bringing fresh particles into contact. The centrifugal force also sets up a rotation of the liquid in the casing. The suspension to be ground enters at the top and is discharged at the bottom of one side. A very powerful hammering action is obtained. Heat and elec. effects assist in the comminution, the latter tending to keep the fine particles sepd. Difficulties as regards shaft packing and strength of parts have been partially overcome, the latter by using "spring steel plate." A fineness of 0.3μ is obtained at 20, of 0.1 μ at 30 and colloidal size at 40 m. per sec.

C. C. HERITAGE (*C. A.*)

Chemistry, Physics and Geology

21. The equilibrium diagram of the iron-silicon system. TAKEJIRÔ MURAKAMI. *Science Reports Tôhoku Imp. Univ.*, **10**, 79–92(1921).—By means of magnetic and thermal analyses, as well as microscopic observation, the Fe-Si alloys contg. less than 32.7% of Si are thoroughly investigated, and the equil. diagram obtained by Guertler and Tammann is revized. In this system, 2 compds., Fe_3Si_2 and FeSi, are found. The former is magnetic, with its critical point at 90°, while the latter is non-magnetic. F. P. PHELPS (*C. A.*)

22. A new heating microscope for high temperatures : with synchronous revolving nicols. K. ENDELL. Berlin. *Z. Krist.*, **56**, 191–93(1921).—Description of a relatively simple app., made by Leitz. It is useful in detg. m. ps., in observing sintering in Portland cement mixts., ore-flux mixts., etc., and in the study of changes in glasses and enamels. E. T. WHERRY (*C. A.*)

23. Water content of heulandite. K. H. SCHEUMANN. *Ber. Ver. Sachs.* **73**, 3–113(1921).—The results of this elaborate study are shown in the figures of 18 analyses, 15 charts of curves, and hundreds of detns. of H_2O in the mineral under different conditions, the figures of which are assembled in more than 15 tables. (*C. A.*)

24. The colloidal system of silica-alumina. J. SPLICHAL. *Chem. Listy*, **15**, 53–56, 88–90, 110–13, 140–43, 164–67(1921).—The following observations were noted during the expts.: The hydrosols, silica and alumina, ppt. each other. Even if the colloidal particles at certain conditions of concn. fail to ppt. and settle out, then the viscosity and the opalescence of the mixt. of hydrosols are to be considered as evidence of the beginning of coagulation in the system. The opalescence is caused by the dispersion phase, which septs. first in a solid form. In these cases the solid phase always remains dispersed, does not settle out and its quantity is not increased with time. In the same manner Freundlich (cf. Ishizaka, *C. A.*, **7**, 2878) and Paine (*Kolloid. chem. Beihefte*, **4**, 24(1912–13)) found that in order to obtain a measurable

coagulation in simple hydrosols, the added electrolyte must be present in a certain definite concn. The pptn. is due only to the reciprocal action of the hydrosol particles. The electrolyte, present in the hydrosols in very small concns. has no effect on the pptn.; the viscosity is decreased. The pptn. is most rapid and the viscosity is greatest in a hydrosol mixt. in which the concn. ratio of Al_2O_3 to SiO_2 is 1:3. The prepn. of the alumina hydrosol from com. Al acetate according to the procedure of Crum (*Ann.*, **89**, 156(1854); *J. prakt. Chem.*, **61**, 90(1854)) did not prove successful owing to the presence of small amts. of H_2SO_4 in the Al acetate. H_2SO_4, even in very small amts., coagulated the alumina hydrosol. To avoid this, S. prepd. the Al acetate by the action of pure $C_2H_4O_2$ on pure Al. The excess of $C_2H_4O_2$ was removed by steam distn. JOHN M. KRNO (*C. A.*)

25. **Boron and silicon chemistry. Experimental investigation of very volatile material.** ALFRED STOCK. *Ber.*, **54A**, 142–58(1921).—This is a resumé of S.'s very numerous contributions to the knowledge of the properties of B and Si. A subject index to the articles in which the various parts of S.'s vacuum app. are described is included. To those interested in this field this resumé will be of great value as a means of ready reference to S.'s already voluminous publications. A. R. MIDDLETON (*C. A.*)

26. **Industrial electrosmosis.** F. ROWLINSON. *Beama*, **8**, 341–45(1921).—Clay treated by the electrosmose process is remarkably fine and plastic. C. G. F. (*C. A.*)

27. **Plasticity of clays.** J. W. MELLOR. *Trans. Faraday Soc.*, **1921**, May 31 (adv. proof).—M. discusses the theory of the plasticity of clay from the standpoint of physical and mechanical properties, and also the relative value of the factors involved in proposed formulas for plasticity detn. An app. is described for measuring plasticity by means of forming spheres of standard size and applying pressure until outside cracks appear. In consideration of plasticity, he discusses grain size of clay, effect of acids, alkalies and salts on sedimentation, and the action of colloidal matter. Directions are given for isolating colloidal clay by suspension and evapn. RUSSELL M. JONES (*C. A.*)

28. **Thermal expansion of some substances. I.** KARL SCHEEL. Phys. Tech. Reich. *Z. Physik*, **5**, 167–72(1921).—The measurements are made by a direct method for large specimens and by a Fizeau dilatometer for small ones. Values are given from $-190°$ to $+500°$ for Al, Mg, Ag, *quartz, porcelain and some Jena glasses*, and from $-190°$ to $+100°$ for invar and some other special alloys. **II.** J. DISCH. Phys. Tech. Reich. *Ibid.*, 173–75.—D. measures with a Fizeau dilatometer the values for Cr, Mn, Mo, Ni, Ta, W, and "Elektron." F. C. HOYT (*C. A.*)

29. **Progress of colloidal chemistry in ceramics since the end of the world war.** H. ARNOLD. *Kolloid-Z.*, **29**, 105–106(1921). E. J. C. (*C. A.*)

30. **Calcium silicide—a new deoxidizing agent.** W. S. ANDERSON. *Raw Material*, **4**, 51–52(1921).—$CaSi_2$ performs 2 principal functions when added to a molten bath of iron or steel: (1) as a deoxidizing agent, (2) as a reheater.

In performing function (1) it combines with O forming $CaSiO_3$, which rises to the top of the bath in a manner similar to all slags and leaves no harmful inclusions in the metal. The reaction is extremely vigorous, hence, its reheating power. H. C. PARISH (*C. A.*)

31. The equilibria of permutites. F. W. HISSCHEMÖLLER. Univ. Technique, Delft. *Rec. trav. chim.*, **40**, 394–432(1921). (*C. A.*)

32. Ultramarine pigments. AUGUST CHAUDET. *Anales soc. quim. Argentina*, **8**, 100–4(1920).—C. cites the following expts. to support the belief that the ultramarines are solid solns. of S. If kaolin be treated with a hot concd. soln. of Na polysulfide a blue color is produced. By using either natural or artificial NaAl silicate instead of kaolin a much more intense blue is produced. If to a boiling concd. soln. of Na polysulfide an excess of dry hydrated silica be added an intense blue or violet color is produced. Slaked lime and cold concd. Na polysulfide give a blue or green color, $Mg(OH)_2$ gives the same result and so does dry starch. L. E. GILSON (*C. A.*)

33. Melting and boiling point of minerals. II. L. H. BORGSTRÖM. *Öfvers Finska Vetensk. Soc. Förh.*, **59**, A, No. 16, 14 pp.(1917); continuation of *C. A.*, **9**, 2364.—For practical purposes the ratios between the b. ps. of liquids, on the abs. scale, are the same at all pressures. Using Cl_2 as a standard of reference, this relation is shown to hold for a number of org. and inorg. substances. Extending the method to substances of geological interest, the approx. b. p. is calcd. for 14 minerals at 93 atm. pressure. E. T. W. (*C. A.*)

34. White clays and bauxites of central Georgia. ANON. *Chem. Met. Eng.*, **25**, 672(1921).—The Cer. Exp. Sta. of the U. S. Bur. of Mines located at Columbus, Ohio, has entered into a coöperative agreement with the Central of Georgia R. R. through its industrial agent, J. M. Mallory, and its president, William A. Winburn, whereby the Cer. Sta. is to investigate the white clays and bauxites along the right of way of the R. R., the lines of which pass through about 80 % of the white clay and bauxite belt of Ga. H. F. S.

35. The clays of the Tandil Mts., Argentine Republic. M. A. ZAMBONI. *Anales soc. quim. Argentina*, **8**, 190–99(1920).—Complete phys. and chem. analyses of several clays are given. L. E. GILSON (*C. A.*)

36. Graphite ore-deposits in Norbergs Bergslag. GUSTAF T. LINDROTH. *Geol För. Förh.*, **40**, 27–76(1918).—The history and production of the graphite deposits are reviewed, and their geology and petrography described in detail. E. T. W. (*C. A.*)

37. Some American dolomites. BURLEIGH B. REED AND NICHOLAS KNIGHT. *Proc. Iowa Acad. Sci.*, **26**, 377–78(1919).—Typical specimens of rock used for building stones in their respective localities were obtained in order to make a comparison of their chem. compns. Following are results of analyses: (1) From Mt. Vernon, Iowa; Niagara formation; yellowish gray, due to Fe. SiO_2 1.29, $Fe_2O_3+Al_2O_3$ 0.57, $CaCO_3$ 55.17, $MgCO_3$ 43.04, sum 100.07%. (2) West Chester county, New York; a typical dolomite not materially different from the Iowa rock. SiO_2 2.71, $Fe_2O_3+Al_2O_3$ 1.05, $CaCO_3$ 53.43, $MgCO_3$ 42.93, sum100. 12%. (3) Lockport, New York; Niag-

ara limestone. SiO_2 2.76, $Fe_2O_3 + Al_2O_3$ 1.42, $CaCO_3$ 51.85, $MgCO_3$ 43.94, sum 99.97%. This contains a sufficiently high per cent of $MgCO_3$ to class the rock as a fairly typical dolomite. (4) Milk-white crystals encrusting the foregoing specimen: SiO_2 0.18, $Fe_2O_3+Al_2O_3$ 1.21, $CaCO_3$ 81.62, $MgCO_3$ 17.15, sum 100.16%. This deviates widely from a true dolomite, as the Ca has quite largely replaced the Mg. (5) Betram, Iowa, between Mt. Vernon and Cedar Rapids. The rock is gray in color, with numerous light-colored crystals disseminated through it. Former analytical data seemed to indicate that the Mg content of the rock was in excess of the Ca, but the new work shows this to have been erroneous: SiO_2 0.90, $Fe_2O_3+Al_2O_3$ 0.90, $CaCO_3$ 55.61, $MgCO_3$ 42.58, sum 99.99%. The figures indicate a rather typical dolomite, as one would naturally expect from similar formations in the neighborhood. W. G. GAESSLER (*C. A.*)

38. The relation of structure to free alkali in sodium silicate solutions. WM. STERICKER. Mellen Inst. *Chem. Met. Eng.* **25**, 61–62(1921).—Ultramicroscopic exam. of sodium silicate solns. shows that they are 2-phase systems in which the disperse phase has a negative charge. This probably explains the discrepancies between detns. of the degree of hydrolysis by various methods. WM. STERICKER (*C. A.*)

39. Fluorspar and cryolite in 1920. HUBERT W. DAVIS. U. S. Geol. Survey, *Mineral Resources of U. S., 1920*, Part II, 65–80(preprint No. 9, published Sept. 1921). E. H. (*C. A.*)

Gypsum in 1920. RALPH W. STONE. U. S. Geol. Survey, *Mineral Resources of U. S., 1920*, Part II, 55–64(preprint No. 8, published Aug. 31, 1921). E. H. (*C. A.*)

PATENT

40. Decomposition of silicates. RITARÔ HIROTA. Japan 37,165, Sept. 25, 1920. Silicates, such as clay, feldspar, etc., are easily decomposed by heating with Na_2CO_3 or similar compd. and then treating with dil. H_2SO_4 or similar compd. *E. g.*, a mixt. of clay 100 parts and Na_2CO_3 70 is heated to dull redness for 1 hr., the product is heated with excess of 20% H_2SO_4 at about 100° during 1.5 hrs. K_2SO_4 and $Al_2(SO_4)_3$ thus produced are extd. with H_2O and pure SiO_2 remains in the residue, 95% of the clay is utilized. (*C. A.*)

Refractories and Furnaces

41. Report of the Refractory Materials Research Committee to the Institution of Gas Engineers. L. BRADSHAW AND W. EMERY. *Gas J.*, **155**, 157–60 (1921).—*Jointing materials for refractories. I. Softening point of mixtures of silica brick and clay firebrick.* Various mixts. of finely ground SiO_2 brick with fireclay brick were made into cones and the refractoriness was detd. The addition of a small amt. of fireclay to SiO_2 brick produces a greater effect than a corresponding amt. of SiO_2 brick added to fireclay brick. Thus the addition of 25% fireclay to SiO_2 brick reduces the refractoriness by $4\frac{1}{2}$ cones, and of about 43% by 6 cones, while the addition of these amts. of SiO_2 brick to

fireclay brick produces differences of 2 and 3 cones, resp. The eutectic mixt., which softens at Seger cone 19–20, has the compn. 15.01% Al_2O_3, 80.32% SiO_2, corresponding to 1 Al_2O_3 : 9 SiO_2. By submitting some of the same mixts. to a refractory test under load, it was found that the differences between the softening temps. with and without load are less in the case of siliceous mixts. than for those rich in fireclay (*C. A.*, **10**, 1782; **12**, 2118). When coarser-grained mixts. are used, the effect upon the softening point is less marked. *II. Mixtures of fireclay with fireclay grog.* The effects of mixing carefully graded amts. of grog and fireclay in the prepn. of mortars are discussed. Grog diminishes the shrinkage of the clay but also reduces the binding power and mechanical strength and makes the mixt. more difficult to spread. Coarse, medium and fine grades of clay and grog were formed into briquets for the measurement of contraction and resistance to crushing. The results are tabulated. The sharp increase in the contraction of the clay with diminishing grain size is clearly shown, as also the corresponding increase in mechanical strength, and the resistance to slag penetration. The addition of 50% of grog of the same grade largely reduces the contraction, and allows a greater penetration of slag. Differences of the same kind, but of less magnitude, are obtained by the use of only 33% of grog. Also a briquet of fine clay with coarse grog has a much greater contraction and crushing strength, and suffers less slag penetration in the mass than a mixt. of coarse clay with fine grog. Of the mixts. examnd., those composed of mixed grades of clay and grog appear to give the best results, being mechanically strong, with a sufficiently small contraction, and settling between bricks to a hard, compact mass, which is free from cracks and is not easily attacked by molten slags. By substituting ungraded building sand for grog, much inferior results were obtained. Study is being made of the beneficial effects that the addition of a small amt. of fine SiO_2 to mixts. of clay and grog would have. *Influence of oxidizing and reducing atmospheres on refractory materials. I. Behavior of clay pyroscopes and fireclay bricks in coal gas.* *C. A.*, **15**, 2972.

J. L. Wiley (*C. A.*)

42. Behavior of refractory materials under load at high temperature. K. Endell. *Stahl u. Eisen*, **41**, 6–9(1921).—See *Jour. Am. Ceram. Soc.*, **4**, 417, 1921.

43. The preparation of the dolomite-tar mixture in Thomas (basic converter) steel works. Max Backheuer. *Stahl u. Eisen*, **41**, 954(1921).—The chem. and phys. properties of the dolomite have an important bearing on the life of the converter lining. Burnt dolomite with slight loss on ignition is best but the dolomite should not be sintered since this prevents the absorption of the tar. The mixt. for the converter walls should contain 35–40% powder, 30% fine and 30% coarse dolomite mixed with 8–10% of tar. The converter bottoms are made from a mixt. of 45–50% powder, 25% fine and 25% coarse dolomite with about 12% tar. R. S. Dean (*C. A.*)

44. A method for the determination of the hardness of refractory materials at high temperature. E. Rengade and E. Desvignes. *Compt. rend.*, **173**,

134–37(1921).—Ludwick's modification of the Brinell test for hardness was applied to 8 clay bricks and 1 bauxite brick maintained at temps. varying from 1050° to 1490° in a graphite resistance furnace. Analyses of the compns. show that the Al_2O_3 content has small effect, but that the presence of alkalies causes considerable diminution in the hardness values. W. M. CLARK (*C. A.*)

45. **Manufacture of fireproof materials and their use.** ERNEST SCHRIEBER. *Feuerungstechnik*, **15**, 69–70(1921).—*Schamotte* is made by mixing together fireclay and quartz and burning the mass to a hard stone. Quartz-free schamotte contains clay and schamotte, while quartz-schamotte contains quartz also. Quartz-schamotte stone under 3% Al_2O_3 is considered acid. *Dinas stone* has a high SiO_2 content in the form of quartz. German Dinas stone is made by binding quartz with a refractory clay, and contains 84–90% SiO_2. English Dinas stone is made by binding quartz with CaO, and contains 97–98% SiO_2. The quartz must be calcined or the stones will swell. The mixts. are pressed together into forms, carefully dried and burned at 1500°F. Dinas stone is used in masonry which must withstand a very high temp. and is highly acid. In making MgO stone, $MgCO_3$ is burned, then ground, bound with tar and formed into shape. The mixt. is then burned at a very high temp. It is used in open-hearth furnaces, etc. Refractory bricks should not be set up with common clay but with a refractory mortar. For use with basic materials, a good mortar consists of 2 parts schamotte meal and one part plastic fireclay mixed with water to the proper consistency. For acid materials a mixt. of quartz meal and clay of high SiO_2 content is used. Refractory materials should not melt lower than Seger cone 26. Anything lower cannot be considered as a refractory. The best schamotte stone melts at 36 and the SiO_2 stone at 35. H. C. P. (*C. A.*)

46. **The siliceous rocks considered from the viewpoint of manufacture of silica bricks.** L. BERTRAND AND A. LANQUINE. *Bull. offic. direc. recherch. sci. ind.*, Nos. 1 and 2, **1919**, 121–27; *Rev. géol.*, **1**, 408–10(1920).—A discussion of the effect of the amt., nature, and mode of distribution of impurities in SiO_2 rocks on their use for making SiO_2 brick. E. T. WHERRY (*C. A.*)

47. **Carborundum refractories in heat-treating furnaces.** M. L. HARTMAN. *Trans. Am. Soc. Steel Treating*, **1**, 601–603(1921).—In addition to superior resistance at high temps., the elimination of extensive repairs compensates for a higher initial cost when carborundum is used. W. A. MUDGE (*C. A.*)

48. **The question of the liquefaction of carbon.** SIEGMAR MÜNCH. Wolfen. *Z. Elektrochem.*, **27**, 367–68(1921).—It has been found that graphite becomes plastic before reaching its m. p. With sufficiently high amperage small graphite rods can be melted through and welded together again. A description is given of an app. for melting large quantities of C.
H. JERMAIN CREIGHTON (*C. A.*)

49. **Employment of aluminothermic corundum as a refractory product.** ALBERT GRANGER. *Bull. official direction recherches sci. in. inventions*, **1921**, 297–300.—Crude corundum was pulverized, washed, treated with H_2SO_4, first cold then hot, until no further action was observed. It was then further treated with HCl and thoroughly washed with water. Several formulas are

given for prepg. mixts. to be fashioned into utensils for firing. Thus, corundum to pass a 150 sieve 8 parts, kaolin des Eyzies 1, argile de Berneçay 2. The mixt. is fashioned and fired. The product was found to withstand sudden changes in temp. and to bear the temp. of melted Pt without much fusion.

L. W. Riggs (*C. A.*)

50. Laboratory type of electric furnaces. Ezer Griffiths. *Beama*, 9, 12–18(1921).—An illus. review. G. broadly classifies elec. lab. furnaces as follows: (1) Wire or ribbon wound tubular furnaces; (2) graphite spiral furnaces; (3) C tube furnaces; (4) W and Ir tube furnaces; (5) zirconia and yttria tube furnaces; (6) granular resistor furnaces; (7) induction furnaces, low and high frequency types; (8) arc furnaces; (9) cathode ray furnaces.

C. G. F. (*C. A.*)

51. Electric heating furnaces in steel works. V. Guillerman and M. Gillot. *Revue industrie minérale; J. four élec.*, 30, 38–40(1921).—The use of *conducting-hearth furnaces* is a step towards insuring high quality steel. Conducting hearths are of two kinds: (1) the hearth with no resistance and (2) the resistance or heating hearth. In furnaces embodying the second type of conducting hearth heat is developed in the hearth by its own elec. resistance. This heat supplements the heat developed in the metal charge by reducing the amt. of heat given up by the charge to the hearth. The requirements to be met in constructing such a hearth are: (1) to obtain in the upper layers of the hearth enough elec. resistance and good thermal conductivity; (2) in the lower layers to obtain very low resistance and low thermal cond. From 10 to 15% of the total power used in a furnace may be expended in the hearth. In the construction of this hearth Cu bus bars are placed horizontally at the bottom of the furnace and bedded in a graphite and tar mixt. Above this the hearth is built up of a mixt. of magnesite or dolomite with graphite and soft Fe filings rammed into place with tar. The amt. of graphite and filings in the mixt. decreases as the hearth is built up and becomes *nil* at some distance from the surface. The cond. of the lower portion may be increased by embedding mild steel bars placed vertically with their lower ends in contact with the layer of graphite, their upper ends at a distance below the surface of the hearth depending on the resistance desired in the hearth. Such bottoms may last for 1000 heats on account of the variation in temp. during a heat being less in a furnace with this hearth than in an ordinary furnace; also, the high temp. of the surface of the hearth allows more satisfactory burning in of magnesite or dolomite patches.

Louis Jordan (*C. A.*)

52. A new electric muffle oven for temperatures up to 1350°. H. Seibert. Berlin. *Chem.-Ztg.*, 45, 772(1921); 3 cuts.—A brief description, without dimensions, of an oven made by H. Seibert & Co., Berlin, in which the resistor is nearly pure C so placed that the rectangular horizontal muffle is heated from 4 sides. It may be constructed for use with any kind of current, is easily repaired, and an oxidizing or reducing atm. may be held in the app.

J. H. Moore (*C. A.*)

53. Researches with a flame of exceptionally high temperature. E. Hauser and E. Rie. *Sitz. Akad. Wiss. Wien*, Abt. IIa, 129, 539–47(1920).—

A flame and burner are described by which it was found possible to reach a temp. of at least 3000°, the highest ever attained without the use of elec. energy. A liquid inflammable hydrocarbon is dispersed from the burner into a horizontal cone by H_2 gas. This cone is surrounded by an outer mantle of O_2 issuing from the outer part of the burner. The resultant flame is about 1 meter long, is luminous from incandescent colloidal C, and gives a continuous spectrum. If a rod of C is placed in the flame a layer of crystal graphite forms where the central hottest part of the flame has been in contact. If a porcelain plate is held in the flame a layer of soot or amorphous C is first deposited, but this is transformed to graphite when heated for a longer time in the hottest portion of the flame. This *graphite* possesses an unusual appearance. It consists of thin sharp platelets with a distinctly metallic cast on the side next to the porcelain, together with some small, transparent, strongly refracting crystals. On the other side the deposition is in fairly regular hexagonal figures similar in appearance to those resulting from the pptn. of colloidal graphite. Soot from camphor and wood charcoal both produce similar graphite in this flame. SiC_3 and carborundum are easily formed, and Zr, W, Mo and Cr melted. Excellent photomicrographs are given. The graphite was identified through its conversion to yellow graphitic oxide by the method of Staudenmaier (*Ber.*, **31**, 1481(1898); **32**, 1394 and 2824(1899)).

G. L. CLARK (*C. A.*)

54. Electric furnaces: Laboratory types. EZER GRIFFITHS. *Beama*, **9**, 145–50(1921); cf. *C. A.*, **15**, 3249.—A review. In this installment C resistor furnaces, the Arsem furnace and high (gas) pressure furnaces are dealt with in detail. Well illustrated. C. G. F. (*C. A.*)

55. The importance of air supply in combustion of coal. HENRY KREISINGER. *New Jersey Ceramist*, **1**, 39(1921).—A general discussion of the processes of the combustion and their control in the operation of hand fired furnaces. C. W. PARMELEE.

PATENT

56. Kiln and method of operating the same. LOIS M. UNDERWOOD. U. S. Reissue U. S. 15,186, Aug. 30, 1921. Original U. S. 1,337,298, April 20, 1920. In a kiln provided with a stationary furnace and a gas producer chamber, and a conduit forming a passageway from the chamber to the combustion chamber of the kiln, and an auxiliary air conduit through which additional air is supplied to the combustion chamber, and a portable grate including a series of hollow tilting bars with nozzles through which steam and air are injected into the bars, a series of tuyeres mounted on each bar and having air passages communicating with the interior of the bars, and an individual steam injecting nozzle extended into the nozzle of each of the bars.

BOOK

57. The Electric Furnace. J. N. PRING. London: Longmans, Green and Co. 485 pp. 32s. (*C. A.*)

Abrasives

PATENT

58. Apparatus for making carbides. J. H. Reid. Can. 180,785, Dec. 4, 1917. Electrodes are placed in combination with means for feeding material to and between them and a support or hearth which retains material not fully converted within the zone of reaction until conversion is completed and which provides for the continuous flow of the converted product from the zone of reaction. Means are specified for varying the position of the zone of reaction with respect to the material in order that arcing may be prevented. (*C. A.*)

Whiteware and Porcelain

59. Glimpses of Ohio ceramic industries—II. Chester H. Jones. *Chem. Met. Eng.*, **25**, 619-22(1921).—A general description of methods and equipment used in the mfg. of tableware in the plant of the Crooksville China Company, at Crooksville, Ohio. H. F. S.

60. Physical and mechanical testing of porcelain insulators. O. Boudouard. *Ceramique*, **26**, 79(1921); *Keram. Rundschau*, **29**, 496(1921).—Permeability, comp. strength and resistance to temp. changes were tested on porcelain insulator bodies. The test pieces in each case were cylindrical in shape having a diam. of 50 mm. and ht. of 5 mm. for the permeability tests, and a diam. of 30 mm. and ht. of 60 mm. for the comp. tests. Those used for studying the resistance to sudden temp. changes had a diam. of 100 mm. and heights of 5 mm., 15 mm., 25 mm., 35 mm., 45 mm. and 55 mm., respectively. The test pieces for permeability tests wree turned on a potter's wheel while the others were made dry press in a metal mold. The chem. analyses of the different bodies follow:

	1	2	3
SiO_2	72.21	67.87	70.01
Al_2O_3	22.26	26.88	25.30
CaO	0.78	0.89	0.61
MgO	0.17	tr.	tr.
K_2O	1.42	2.29	3.67
Na_2O	2.38	1.50	0.49

1.	RO	3.20	Al_2O_3	18.13	SiO_2
2.	RO	4.17	Al_2O_3	17.85	SiO_2
3.	RO	4.23	Al_2O_3	20.08	SiO_2

The permeability was measured by sealing the test pieces in a glass tube and noting the amt. of water which passed through. All test pieces tested were impervious to water. In testing the resistance to sudden temp. changes the specimens were placed in running water at 13°C for 15 mins. after which they were plunged into boiling water. This was repeated 3 times for each specimen. Bodies 1 and 2 withstood these tests well except that the 5 mm. pieces were somewhat warped. The test pieces showed many cracks.

		Compressive strengths.		Load in kgs.	kgs. cm.^{2}
1	7.07 cm.^{2}	14,250	8,500	11,000	1,591
2	.....	12,000	11,600	15,600	1,838

H. G. Schurecht

61. **One solution of the porcelain insulator problem.** E. E. F. Creighton and F. L. Hunt. *Elec. Rev.*, **79**, 17–20(1921); *J. Am. Inst. Elec. Eng.*, **40**, 480–82(1921).—Failure in cemented porcelain insulators is prevented by arresting the expansion of the cement used, through removal of the moisture when it is thoroughly set and preventing the moisture from re-entering it and causing repeated expansions. This is done by impregnating the cement after it has set with a pitch under vacuum and heat treatment. Small pieces so treated can be soaked in H_2O for days without showing absorption. Insulators thus prepd. have been installed on a 66,000-volt transmission line near the seashore for 3 years without a single failure occurring.

L. C. Krueger (*C. A.*)

62. **Tests for laboratory porcelain.** Anon. *J. Proc. Inst. Chem.*, **1920**, III, 210–14; *Analyst*, **45**, 397–98(1920).—The tests described are those adopted by the sub-committee on porcelain of the Glass Research Committee of the Inst. of Chemistry. (1) *Appearance, shape and weight.*—These should at least come up to that of the porcelain in former use. The wts. of vessels should not exceed pre-war av. wts. for articles of similar size. (2) *Tests for porosity of body and imperfections in glaze (dye test).*—A 0.5% soln. of eosin in water answers well. Some vessels are filled and broken pieces of others immersed in the sol. for 18 hours, after which they are rinsed, dried and examd. with a hand lens. Good porcelain shows no staining at all. If the articles fail under this "dye" test, it is extremely unlikely that they will stand the remaining tests. (3) *Resistance to heat and sudden changes of temperature.*—(*a*) The vessels are heated by direct application of Bunsen burners, and then lifted with small cold tongs onto cold pipeclay triangles to cool. This is repeated six times and the "dye" test again applied. (*b*) After thorough drying the same vessels are heated as before and cooled by being placed on cold metal (clean sheet lead). The "dye" test as before is then applied. (4) *Constancy of weight and resistance of glaze to high temperatures.*—(*a*) Vessels should suffer no loss of wt. after heating for several hrs. at a good red heat and should show no tendency to stick to pipe clay, silica or other supports. (*b*) The condition of the glaze should be noted after heating for 4 hrs. at 950°. No blistering or coaging should result. (5) *Cleaning test.*—Cleaned, ignited and weighed vessels should show no change in wt. after immersion for 12 hrs. in dil. acid followed by rinsing, wiping and ignition. Under this test, if the body is porous, liquid will have entered and on the application of sudden heat particles of glaze or porcelain will be thrown off by vapor generated from the imprisoned liquid, with resulting loss in wt. (6) *Resistance of glaze to acid and alkali.*—The loss in wt. sustained after prolonged treatment with boiling acid, Na_2CO_3 and NaOH should not exceed that found in comparison with high grade pre-war procelain. Two simple *tests for Pb* are finally given: (1) The porcelain is touched with HF, warmed, and the acid allowed to evap., followed by H_2S water faintly acidified with acid. (2) Fragments of the porcelain are heated to bright redness for 4 hours in a current of H_2. No darkening should ensue.

J. B. Patch (*C. A.*)

63. Modern production of (porcelain) suspension insulators. E. H. Fritz and G. I. Gilchrist. *J. Am. Inst. Elec. Eng.*, **40**, 470–79(1921).—A review of progress in making porcelain. The chief improvement is that the feldspar and flint, which were formerly mixed together with the clays in the blungers, are now first wet-ground in ball mills long enough to produce the necessary fineness. The higher dielec. and mechanical strength obtained more than counterbalances the cost to the extra operation. Care in filtering the slip produces filter cakes of such qualities as to eliminate the necessity of aging. Charles Hecker (*C. A.*)

PATENT

64. Baking porcelain insulators. Magoemon Ezoe. Japan 37,166, Sept. 25, 1920. The procelain insulator is set in a round flat box and baked, the top of the insulator being completely covered with glaze. (*C. A.*)

BOOK

65. Chinesisches Porzellan. Otto Pelka. Leipzig: H. Schmidt and C. Günther. M. 30. (*C. A.*)

See also No. 28.

Heavy Clay Products

66. Increase in strength of sand lime brick. W. Drakebusch. *Tonind. Ztg.*, **45**, 1170–71(1921).—The effect of aging on the strength of a no. of sand lime brick was investigated. The following limes were studied: 1. White lime with 90.12% $Ca(OH)_2$ and 0.95% SiO_2.; 2. Hydraulic lime with 73.05% $Ca(OH)_2$ and 19.65% SiO_2; 3. Hydraulic lime with 73. 88% $Ca(OH)_2$ and 15.55 % SiO_2; 4. Hydraulic lime with 88.40% $Ca(OH)_2$ and 5.52% SiO_2 and 5. Hydraulic lime with 74.28% $Ca(OH)_2$ and 12.78% SiO_2. The lime was dissolved in water and mixed with sand. The mixtures were allowed to stand 24 hrs. after which they were molded into test pieces and hardened in an autoclase by subjecting same to a pressure of 8 atms. for 9 hrs. The results are given below and show that the strength of sand lime brick increases upon aging and that hydraulic limes produce stronger brick than white limes.

6% lime	Compress. strength kg./cm.² 7 days	30 days	90 days	180 days	8% lime	Compress. strength kg./cm.² 7 days	30 days	90 days	180 days
				Stored dry					
1a	128	151	137	184	1b	152	166	181	205
2a	209	225	211	227	2b	244	280	302	330
3a	170	219	213	237	3b	153	200	236	261
4a	145	176	190	192	4b	142	173	219	216
5a	197	196	225	222	5b	211	206	238	241
				Stored wet					
1a	119	128	142	193	1b	130	158	146	012
2a	190	208	213	241	2b	239	272	291	303
3a	160	219	219	245	3b	150	170	232	309
4a	133	156	184	192	4b	119	148	191	194
5a	159	177	211	223	5b	103	165	242	242

H. G. Schurecht

67. **A note on body cracking of terra cotta.** E. C. Hill. *New Jersey Ceramist*, **1**, 70(1921).—The author concludes that fire cracking may not be due to variations in the firing temp.; that it seems possible to crack a body of almost any compn. by too rapid cooling; that a considerable range of compn. is possible in bodies without producing fire cracking, if the pieces are cooled slowly; dense bodies are more sensitive, therefore the use of grog of suitable size and quantity is advisable; the greater the amt. of sandy clays used the greater the contraction between 650° and 850°C; the most effective prevention is slow cooling at the lower temps. particularly from 650° to 500°C.

68. **Some causes of the so-called disintegration of terra cotta brick, and allied ceramic material and suggested remedies.** H. A. Plusch. *New Jersey Ceramist*, **1**, 65(1921).—Discussed under the following headings (1) High porosity of the body; (2) High silica content of the body; (3) The effect of sol. salts; (4) Poor workmanship; (5) Lack of mortar in joints and poor mortar; (6) Uneven thickness of ware; (7) Effect of the sun and frost; (8) Settlement of buildings. C. W. Parmelee

69. **Properties and tests of tiles.** Anon. *Kalk-, Gips- u. Schamotte-Ztg.*, **27** (Nov. 21, 1920); *Chimie & industrie*, **6**, 206(1921).—There are as yet no official standards for tiles; and moreover their properties vary within very wide limits according to the method of manuf., *e. g.*, the crushing strength can vary from 25–250 kg., the lower values being found with hand-made tiles. Certain dealers and municipalities have adopted regulations varying according to the nature and shape of the tiles and covering the amt. of H_2O absorbed, tightness to water, content of noxious substances, apparent sp. gr., d., fragility, resistance to the action of frost, uniformity, and color. Certain of these properties can be easily gauged, while others require special tests carried out on the roof itself. A. P.-C. (*C. A.*)

70. **Manufacture of gas-clinker brick at the Wurzburg gas plant.** F. Greineder. *Gas. u. Wasserfach*, **64**, 245–47(1921).—Bricks suitable for building purposes are being made from the clinker from the gas retorts and generators. The plant has sufficient assorted clinker to make 1,150,000 bricks yearly. For making 1000 bricks there is required 4.5 cu. m. of ground clinker, 0.5 cu. m. of cement, 0.8 cu. m. of water. The total cost per 1000 bricks, including depreciation and interest charges, is 437.19 marks. About 7.5% is being realized on the investment. J. L. Wiley (*C. A.*)

71. **The artificial drying of bricks.** F. Scholz. *Kalk-, Gips- u. Schamotte-Ztg.* **27**, Nos. 3 and 4(Feb. 27 and 21, 1920); *Chimie & industrie*, **5**, 559(1921).—Review of the various sources of heat used for the drying of bricks: exhaust steam, heat lost by radiation from the kilns, heat lost from the kilns in the cooling chambers, flue gases from the kilns and from the boilers.

A. P.-C. (*C. A.*)

72. **The utilization of slag: The manufacture of slag building bricks.** H. Koch. *Industriebau*, **12**, 23–27(1921); 13 illus.—Detailed account of the Elberfeld plant. Relative costs for 1 cu. m. of wall: Ordinary clay or red brick requires 114 kg. coal in the course of manuf.; slag brick with Portland

cement binder, 64 kg. coal; slag brick with blast furnace cement binder, 33 kg. coal. C. G. F. (*C. A.*)

73. The equipment and operation of Brooklyn Crozite brick plant. ANON. *Concrete*, **18**, 74–78(1921).—This plant is of special interest as a products manufacturing achievement in the elimination of manual labor. Its working capacity is 100,000 concrete brick per 8-hr. day. In recent tests concrete brick show a remarkable superiority over clay brick, as well as an unusually uniform quality. F. H. HOTCHKISS (*C. A.*)

PATENTS

74. Bricks; pottery. C. W. WALLACE. Brit. 162,483, March 11, 1920. Bricks, pottery, and artificial stone products are obtained from clayey material, *e. g.*, as the white clayey material found near Molo in British East Africa, by introducing pressed, turned, or otherwise shaped, or unshaped pieces of the clay directly into the flames of a furnace, heating throughout, and effecting sudden cooling by plunging into H_2O, etc. (*C. A.*)

75. Furnace for manufacturing tile. TÔDA MOROTA. Japan 37,173, Sept. 28, 1920. The furnace has 2 doors opposite each other. Flames are conducted to the top of the furnace, then to the inner part through shelves on which tiles are placed. (*C. A.*)

Glass

76. Graded seal for joining Pyrex to lead glass. W. C. TAYLOR AND AUSTIN BAILEY. App. Div. Corning Glass Works, Corning, N. Y. *J. Ind. Eng. Chem.*, **13**, 1158(1921).—A seal consisting of five glasses intermediate between Pyrex and lead glass has been developed. All of the intermediate glasses are of a lead-free borosilicate compn., and are comparatively stable and can be worked repeatedly without devitrification. ED.

77. Tests for laboratory resistance glassware. ANON. *J. Proc. Inst. Chem.*, **1920**, Part III, 202–10(1920); *Analyst*, **45**, 396–97(1920).—The Glass Research Committee of the Inst. of Chemistry use the following tests to ascertain whether or not lab. glassware may safely be considered as resistance glass: (1) *Preliminary treatment.*—Cleaning with boiling water followed by 5% acetic acid. (2) *Treatment in autoclave.*—This affords a rapid sorting test for resistance glass. The glass vessel, filled with distd. water, is heated for 3 hrs. in an autoclave at a registered pressure of 4 atms. Any matter dissolved is then estd. by drying a portion of the soln. for 1 hr. at 120°, followed by ignition (not above 650°) for 3 min. The result is expressed as mg. residue per sq. dm. The alkalinity of the rest of the water is detd. by titration with methyl orange as indicator. Results are expressed as cc. 0.01*N* H_2SO_4 per sq. dm. Residue must not exceed 4 mg. per sq. dm. Alkalinity should not require more than 5 cc. 0.01*N* H_2SO_4 per sq. dm. The glass must not flake nor peel. (3) *Treatment with reagents.*—HCl (sp. gr. 1.15) is boiled for $^1/_2$ hr. in the vessel to be tested, the whole being kept in an air bath at 140°. This is repeated 3 times (each time with fresh acid), and finally the dissolved residue is dried down with a little $(NH_4)_2CO_3$, ignited and weighed. SiO

and Zn are both to be tested for in the residue; after the acid treatment the same vessel is tested by boiling in it 0.5 N NH_4Cl and NH_4OH, the dissolved matter, if any, being detd. as before; all results are expressed as mg. per sq. dm. Finally 0.5N NaOH is employed, the residue being tested for Zn and Pb. Residue from HCl test must not exceed 2 mg. per sq. dm., and that from NH_4Cl and NH_4OH test 1.5 mg. per sq. dm. (4) *Heat tests.*—Alternative methods. (*a*) The flask or beaker is heated in an air oven to 120° for $^1/_2$ hr., and then instantly immersed in cold water. (*b*) The vessel is filled with soft paraffin wax and heated to about 155° and plunged in cold water; this is repeated at increasing temps. (25° intervals) until it breaks. Good quality vessels will stand this treatment up to 200°. (*c*) A soln. of $CaCl_2$ (sp. gr. 1.33) is boiled in the vessel for 5 min. and the whole then plunged into water at 0°. (*d*) Another vessel full of water at 0° is plunged into boiling water. Vessels should not crack when submitted to tests under (*a*), (*c*) and (*d*). (5) *Tests for As and Sb.*—Full accounts of testing for these elements are given, with a diagram of the app. for distn. (6) *Annealing.*—The vessels are examd. under polarized light to detect internal stresses. J. B. PATCH (*C. A.*)

78. Plate glass manufacture. *Glassworker,* **41,** No. 10, 1, Dec. 3(1921); from *Ford News* of Nov. 15, 1921.—The Ford Co. announces a new method of making plate glass for windshields. The batch is melted in a 355 ton tank and flows from this onto a moving sectional cast iron table which travels under a stationary roller adjusted to the desired thickness. Sheets are 24″ wide by $^3/_8$″ thick. The conveyor plates are cooled with soapy water. From the table the conveyor carries the glass through a 464 ft. leer in 2 $^2/_3$ hours. The continuous sheet is then cut and set on grinding tables each unit 90″ long and passes under 180 ft. of grinding machinery and then under the polishing machinery after being washed. The travel of the glass is continuous from start to finish. R. J. MONTGOMERY.

79. Carrying large plate glass sheets. J. W. CRUIKSHANK. *Glassworker,* **41,** No. 4, 11, Oct. 22(1921).—Large sheets 12 ft. by 20 ft. weighing 1400 lbs. required 16 men to carry by hand. In 1907 a clamp like an ice tongs was installed and this type with improvements is in use today. The present clamp will release and clamp glass automatically due to a simple spring arrangement. One clamp at the center of the top edge is enough and does not cause undue strain. Suction discs have been used to lift glass from the grinding tables to advantage. R. J. MONTGOMERY

80. The electrical properties of glass. J. R. CLARKE. *Beama,* **8,** 235–38 (1921).—A review including a bibliographical list of 38 references. C. makes a number of definite recommendations on the basis of his own experience and that of others. For glass line insulators, in addition to the elec. and mechanical properties, one has also to consider cost. This necessitates the manuf. from cheap materials, in a tank furnace, thus excluding the use of Pb. The surface leakage must be low and hence the resistance to chemical attack fairly high; the specific inductive capacity should be low, to reduce flashover and the dielec. strength fairly high to prevent penetration. The coeff. of ex-

pansion must be low and the glass should be well annealed. All these conditions indicate a glass of high SiO_2 content. A potash-lime glass with as high a SiO_2 content as possible would be best on the basis of present data. Further research is needed. For glass condensers, a Ba-borosilicate glass has so far proved to be most serviceable. C. G. F. (*C. A.*)

81. Glass blowing in scientific and industrial laboratories. H. Vigreux. *Chimie & Industrie*, **6**, 160–68(1921).—Brief historical sketch of the development of glass blowing together with hints on glass blowing, the difficulties encountered by the beginner, and the method of overcoming them.
A. P.-C. (*C. A.*)

82. Standardization of chemical apparatus. Freymuth. Berlin. *Z. angew. Chem.*, **34**, Aufsatzteil, 357–59(1921); 3 cuts.—A standardization of glass app., made of a glass of minimum alkali content, would eliminate useless expenditure and save quantities of cork and rubber materials.
Theo. F. Buehrer (*C. A.*)

PATENTS

83. Glass manufacture. T. C. Moorshead. 10/9/19; Ill. Off. Jour. Pats. 9/7/21. Pp. 3946–48. Covers a multiple automatic glass press. Special feature is the gathering and placing of the gathering in the mold in an unchilled state. Five drawings. Wm. M. Clark

84. Glass Furnaces. W. G. Clark. Brit. Pat. 163,995; Ill. Off. Jour. Pats. 7/20/21. Pp. 3024. An elec. heated delivery trough is used to facilitate starting up in the cold. Heating may be performed by either resistance units or passing alternating current through the glass. Illus. by sketch. Wm. M. Clark

85. Bait for glass-drawing machine and in the process of drawing glass. Arthur E. Spinasse. U. S. Reissue. U. S. 151,143, July 5, 1921. Original U. S. 1,170,464, Feb. 1, 1916. A bait for drawing hollow glass or cylinders from molten glass comprising means for supplying distending air pressure thereto, and means for forming and lifting without adhesion a glass novel. the means being adapted to support the novel without producing rupturing strain thereon during the drawing operation.

86. Method and apparatus for making glass articles. Clyde R. Lott. U. S. 1,382,994, June 28, 1921. The combination of a blank mold and a finishing mold located side by side and each comprising sections hinged to swing horizontally to open the mold, the molds arranged so that each mold is opened at the side facing the other mold and automatic means to transfer a blank by a horizontal movement from the blank of the mold into the finishing mold. C. M. Saeger, Jr.

See also No. 28.

Cement, Lime and Plaster

87. Special high resistance Portland cements. K. Endell. *Zement*, 9, 25–28(1920); *Chimie & Industrie*, **5**, 317(1921).—E. gives the results obtained in the course of tests of special German and Austrian cements which had a

remarkably high strength at the end of 2 days, tensile 10 kg. and compressive 180 kg. [per sq. mm.—ABSTR.]. Such results are of no great practical importance. Müller Rüdersdorf, in the course of the testing of several hundred samples of com. cements, found the following values at the end of 28 days: 8% below 300 kg., 14% 300–50 kg., 26% 350–400 kg., 15% 400–50 kg., 22% 450–500 kg., and 15% 550–600 kg. The strength requirements at present in force are sufficient for all purposes. The production of special cements is easily obtained by adding more CaO, but this entails 2 drawbacks: getting too near the limit where expansion is liable to occur, and greater fuel consumption for burning. These are scarcely compensated by the possibility of removing the forms from the reinforced concrete work at the end of 2 days.

A. P.-C. (*C. A.*)

88. **The behavior of cement mortars in sulfate-bearing waters.** H. NITZCHE. *Zement*, 9, 37–40, 50–53(1920); *Chimie & industrie*, 5, 317(1921).—As a result of serious troubles encountered with concrete work carried out in the neighborhood of Frankfort, where there is a subterranean sheet of sulfate-bearing water, N. carried out numerous tests in which local contractors were interested. Two large tables give a summary of the results obtained on concretes having varying amts. of Portland cement and of slag cement immersed in pure and in sulfate-bearing waters during 1, 2, and 3 yrs. Numerous photographs are given of the test pieces thus treated. Cf. *C. A.*, **14**, 606.

A. P.-C. (*C. A.*)

89. **Experiments with blast-furnace slag.** H. BURCHARTZ. *Stahl u. Eisen*, **41**, 193–200(1921).—The following conclusions regarding the use of blast-furnace slag in *cement* are drawn. The resistance of reinforced concrete to sea water is dependent on the density of the cement. *Cement* from blast-furnace slag made in the following proportions, 1 pt. cement, 2 pts. fine slag, 3 pts. coarse gravel, is as good as silica cement. Cf. *C. A.*, **14**, 3143.

R. S. DEAN (*C. A.*)

90. **The addition of trass to cement.** C. PLATZMANN. *Zement*, 9, 227–28 (1920); *Chimie & industrie*, 5, 317(1921).—Tests carried out on mixts. of 1 part by wt. of cement, 0.5–1 part of trass, and 4, 6, 8, and 11 parts of gravel led to the following conclusions: trass may be added to the mixt. to economize cement, its physical and chem. properties being suitable for the purpose. Cement-trass-gravel concretes were stronger than cement-gravel concretes having the same cement content, owing to the fineness of the trass. From an economic point of view, concretes to which trass has been added are not more expensive than those which do not contain any. A. P.-C. (*C. A.*)

91. **The relation of carbon dioxide and moisture to the setting time of cement** S. L. MEYERS. *Concrete, Mill Section*, **18**, 128–30(1921).—M. states: CO_2 is readily absorbed by tricalcium aluminate. This absorption of CO_2 by the aluminate in Portland cement causes an acceleration of setting time. This acceleration of setting time is due to the positively charged aluminate in dispersion adsorbing the negatively charged carbon ion, resulting in coagulation after the cement is gaged with water. The effect of hydration alone is

to retard the set, but in combination with CO_2 hydration indirectly acts as an accelerant by aiding carbonation. J. C. Witt (*C. A.*)

92. Automatic machine tests setting time. C. R. Hill. *Concrete*, **18**, 126(1921).—A machine is described for automatically detg. the setting time of cements and plasters by means of Gillmore needles. The cement test pat is carried on a plate which moves in a horizontal plane at a speed which may be regulated to accommodate different classes of materials. The needles are lowered to the cement at frequent intervals by the action of a cam.

J. C. Witt (*C. A.*)

93. Artificial paving blocks. J. Klinkmüller. *Verh. Ver. Beförd. Gewerbfleiss.*, **3**, 69–96(1920); *Chimie & industrie*, **5**, 64(1921).—Review of the various materials proposed in Germany for the prepn. of paving blocks and of a series of patents relative to the use of cement or asphalt concretes, with or without reinforcing. A. P.-C. (*C. A.*)

94. Judging the quality of Portland cement. R. J. Colony. *Trans. Am. Inst. Mining and Met. Eng.*, No. **1039** (Feb., 1921).—Chem., mech. and petrographic methods are suggested for detg. the quality of cement to supplement the standard tests. A long series of studies has shown that the 3 constituents that form the bulk of Port. cement (CaO, SiO_2, and Al_2O_3) exist as fixed components with definite chem. compn. and const. optical properties. With these 3 compds. forming apices of a triangle, a diagram is made and the percentages of the samples are plotted. About 50 analyses were plotted on the diagram and all but two fell within a restricted triangular area. The changes of the tricalcium silicate, tricalcium aluminate, tricalcium ferrite, beta calcium ortho silicate and gypsum when H_2O is added to cement are described briefly. Limiting ratios of cement based on a minimum silicate content are used as a check and cements having a lower ratio are regarded with suspicion. The results of tests and anaylses of 6 samples are shown. The use of the limiting ratios is a simple easy method of judging the quality of Port. cement when used in connection with the usual standard tests. Results obtained are so suggestive that further work is now in progress.

C. N. W. (*C. A.*)

95. Relation between tensile and compressive strengths of cement mortars. J. R. Dwyer. *Concrete, Mill Section*, **18**, 99–101(1921).—On the basis of a considerable no. of tests D. concludes: The *T-C* ratio varies greatly with differences in compressive strengths of Portland cement mortars, and also varies somewhat for difference in materials and proportions. The variation is greatest at comparatively low compressive strengths, and below about 1,500 lbs. for 2-in. cubes may be extremely misleading. It is evident from data presented herewith that the tensile test favors cements which are weak in compression, and gives little indication of their comparative compressive strengths. J. C. Witt (*C. A.*)

96. The analysis of fibro-cement. B. J. Smart and P. C. Pecover. *J. Soc. Chem. Ind.*, **40**, 185–6T(1921).—S. and P. det. the approx. % of cement in cement-asbestos mixts. by treating with 20% HCl and detg. the Ca in the

ext. The asbestos adsorbs some SiO_2; hence high results are obtained for the asbestos by direct weighing of the residue. The adsorbed SiO_2 can be extd. with "alkali." E. G. R. ARDAGH (*C. A.*)

97. The cement factory in Torda (Siebenburgen, Hungary). H. SZEKELY AND E. HAVAS. *Beton u. Eisen*, **20**, 41–3, 66–9, 87–90(1921).—Dimensioned drawings give many details. The thick slime process of Smidth & Co. is to be used. Limestone and argillaceous schist are the raw materials. Natural gas is the fuel. JAS. O. HANDY (*C. A.*)

98. Researches on the volume alteration of cement and cement mortars on setting; influence of water addition, the method of mixing and of the cement on the extent of the volume changes; the relation between the length of iron reinforcement and the setting of cement mortar; the rate of expansion and contraction of natural stone when wet and dried. OTTO GRAF. *Beton u. Eisen*, **20**, 72–4 (1921).—A continuation of an undated earlier article. Cf. *C. A.*, **8**, 811. JAS. O. HANDY (*C. A.*)

99. A critical review of the wet process for manufacture of Portland cement. RICHARD K. MEADE. *Concrete, Mill Section*, **18**, 77–85(1921).—A detailed analysis is given, based on considerable data, whether the wet or dry process is best for the manuf. of Portland cement from hard, dry, raw materials. F. H. HOTCHKISS (*C. A.*)

100. The effect of temperature on some of the properties of materials. F. C. LEA. *Engineering*, **110**, 293–98(1920).—The results of expts. conducted in a non-inductively wound elec. furnace are given. They are of special importance to the builder and engineer. The tests include the detn. of the Brinell number, breaking strength, elastic limit, yield point, modulus of elasticity, elongation and reduction of area at fracture of heat cement and reinforced concrete. The effects of varying the temp. gradient and of reheating are also shown. The results are given in curves and some photomicrographs of the treated materials are shown. P. D. V. MANNING (*C. A.*)

101. Determination of available lime in quicklime and hydrated lime. ALICE I. WHITSON. *Chem. Met. Eng.*, **25**, 740(1921).—Details of a modified Scaife method. H. F. S.

102. The slaking of lime. KOSMANN. *Verh. Ver. Beförd. Gewerbfleiss.* No. **5**, 61–65 (May, 1920); *Chimie & industrie*, **5**, 317(1921).—The paste resulting from the interaction of CaO and H_2O during slaking and from the transformation of the $Ca(OH)_2$ to the colloidal state is due to the formation of a gel of Ca tetrahydrate (64%) and of a sol. of lime water (36%) contg. 4.572% of CaO. A. P.-C. (*C. A.*)

103. Rotary kiln lime-burning plant. ANON. *Blast Furnace and Steel Plant*, **9**, 467–68(1921).—An illustrated description of the new plant of the Granite City Steel Works. E. H. (*C. A.*)

104. Fine art of lime burning. GEO. B. WOOD. *Chem. Met. Eng.*, **25**, 705(1921).—General description of methods and equipment used in burning lime in the new plant of the Rockland & Rockport Lime Corporation, Rockland, Me. H. F. S.

105. The cementing qualities of the calcium aluminates. P. H. Bates. *Bur. Stand. Tech. Paper*, **197**.—The four calcium aluminates, $3CaO.Al_2O_3$,$5CaO$, $3Al_2O_3$, $CaO.Al_2O_3$, and $3CaO.5Al_2O_3$, which are the only anhydrous compds. of lime and alumina, were prepared in a pure condition by heating together the proper propn. of the oxides. After microscopic examn. had shown that homogeneous compounds had been formed, the products were finely ground and their cementing qualities when ganged with water were determined. The two compds. higher in lime reacted very energetically with the evolution of much heat, acquiring practically instantaneous set. The two higher in alumina reacted with water more like Portland cement, but showed higher strength at early periods than the latter. These were then prepared in larger quantities and containing such impurities as silica, iron oxide, and magnesia. The two compds. $CaO.Al_2O_3$ and $3CaO.5Al_2O_3$ were burned in a 2 by 20 ft. rotary kiln, varying their compn. so that the silica, iron oxide, and magnesia reached limits of 17.38, 3.10, and 3.66 per cent, respectively, as maxima in a series of eight cements. The process of manuf. was entirely similar to that used in the prod. of Portland cement. The ground cements were used in making the usual small tension and compressive test pieces and 6 by 12 in. gravel concrete cylinders of 1 : 1.5 : 4.5 and 1 : 3 : 9 propns. The striking feature of the data obtained from testing these at different periods up to and including 3 yrs. was the very high 24-hr. strength. The rich concretes prepared from four of the cements developed in 24 hrs. strengths in excess of 2800 lb. per sq. in., and the lean concretes from two of the cements gave strengths beyond 1500 lb. at the same period. Consistent gain in strength was obtained up to 1 yr., when one of the cements in the rich concrete gave a strength of 8220 lbs. per sq. in. Test pieces stored in water tended to show retrogression in strength with age. This was also noted with test pieces stored in the damp closet, but to a much less degree. This action may be explained by the fact that the products of the hyd. of all the aluminates are a hydrated $3CaO.Al_2O_3$ and hydrated alumina (except in the case of the anhydrous $3CaO.Al_2O_3$, when no hyd. alumina is produced). This latter is the cementing agent in these products, and, being colloidal, it is very susceptible to moisture changes. Large amts. of moisture are taken up in the presence of the latter with consequent swelling of the colloid and reduction in strength. H. F. S.

106. Potash shales of Illinois. M. M. Austin and S. W. Parr. *J. Ind. Eng. Chem.*, **13**, 1144–46(1921).—(1) In at least two localities in Illinois, shales occur which contain 5 per cent or more of potash. (2) Shale outcropping in several places near Jonesboro, in Union County, which contains 5 per cent of potash would be suitable, so far as can be determined from its chem. compn. and physical character, for use in the manuf. of *Portland cement*. (3) By using this material in the manuf. of cement and by applying the known methods of potash recovery, a yield of 5.3 lbs. of potash per barrel of cement could be obtained. (4) The constitution of the southern Illinois shale is complex. The shale contains free oil, bituminous matter, pyrite, undecomposed potassium-bearing rock, feldspathic in character, and potassium-bearing material

of the nature of glauconite or greensand. (5) Shale from Dixon, Lee County, contains 5.8 per cent of potash, which is held for the most part in a more stable condition than that in the southern Illinois shale. ED.

PATENTS

107. Floor-coverings. M. ROBERTS. Brit. 162,514, Apr. 6, 1920. A jointless floor covering is made by mixing calcined magnesite with an equal wt. of sawdust, cork dust, or wood pulp moistened with $MgCl_2$ soln. adding 5–10% of French Chalk and 12½% of coloring matter, and subsequently adding $MgCl_2$ soln. at 28° Bé. till the desired plasticity is obtained. The coloring matter may be omitted. According to the provisional specification, asbestos may also be used as an ingredient. (*C. A.*)

108. Portland cement and calcining kiln. JOHN NELSON. Can. 212,734, Aug. 2, 1921. (*C. A.*)

BOOK

109. Portland Cement. RICHARD K. MEADE. Its Composition, Raw Materials, Manufacture, Testing and Analysis. 2nd Ed., Easton, Pa.: The Chemical Publishing Co. 512 pp. $5.00. (*C. A.*)

See also No. 4.

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Ceramic Abstracts

Edward W. Washburn, Editor
Ceramics Bldg., Urbana, Ill.

Abstractors: E. N. Bunting, W. M. Clark, G. S. Fulcher, S. L. Galpin, Seiji Kondo, A. T. Malm, R. J. Montgomery, Louis Navias, C. W. Parmelee, C. M. Saeger, Jr., H. G. Schurecht, R. B. Sosman, H. F. Staley, E. W. Tillotson.

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General and Miscellaneous

1. **Osmosed clay.** H. Hirsch. *Tonind. Ztg.*, **45**, 1243–45(1922).—In a trough-like compartment of the electrosmotic separator are two stirrers which keep the clay agitated. Above these is a slowly revolving drum which is charged positively with an electric current. A few inches below the drum is a wire screen which is negatively charged. The impurities which are positively charged are caught on the screen and washed away while the clay which is negatively charged is attracted to the drum where it is dewatered by electrosmosis and is scraped off by means of long knives into trucks. The clay to be treated by this method is first subjected to a preliminary treatment similar to that used in this country. The clay is blunged with water and electrolytes and slowly passed thru troughs in which the quartz and mica are removed. It is then screened thru vibrating screens and passed over electro magnets and finally passed into large settling tanks. The slip is allowed to stand in these tanks sufficient to remove more of the impurities. The slip remaining in suspension is then run thru the electrosmotic machines of which the Westwälder works has 8. Each machine has a capacity of 8 tons per 24 hrs. A filter press operated on the electrosmotic principal is also described. The raw clay in this case contained considerable quartz and pyrites, and about 60–66% clay substance and had a softening point of cone 31. The osmosed clay contained above 90% clay substance, had a softening point of cone 33 and a much lower vitrification point than the untreated clay.

H. G. Schurecht

2. **Ceramics as a by-product of coal mining in Sweden.** J. W. Beckman. *Chem. Met. Eng.*, **25**, 882.—The thickness of the coal seams in the industrial center of Höganäs, Sweden, varies from 30 to 60 cm. In between the coal seams there are clay and carboniferous slates. These clays have to be mined simultaneously with the coal to make it economical and feasible to bring it out. The clay-products manufacture is now the main operation at Höganäs. The clay, originally a waste product, has become of prime importance, and the quality of the products produced from it has become famous not only in Sweden but in many other countries. *Firebricks, paving bricks, common building bricks, chemical ware, acid proof bricks, terra cotta products, sewer pipes, sanitary ware and household articles are all being made.* The carbonaceous shales are piled in the open and set on fire. They burn completely, leaving a dense well-burned chamotte which is very desirable for the manuf. of pressed brick and other clay products. The company operating the works at Höganäs also operates an elec. furnace plant at Trollhättan, where *alundum* and *carborundum* are produced, and these products are used here as elsewhere in the manuf. of *highly refractory bricks*. Electrodes are also a product of this plant, their manuf. being virtually a cer. industry, though utilizing different raw mats.

H. F. S.

3. **Blasting with liquid air.** Spielman. *Tonind. Ztg.*, **60**, 519(1921).—Discussion as to possibilities for replacing blasting powder and dynamite. Theoretically 1 kg. liquid air possesses as much energy as 2.2 kg. gelatine

dynamite. Found to be impracticable for quarrying purposes. Suitable for mining, but uneconomical owing to necessity of too large scale production, transport and storage difficulties. WM. M. CLARK

4. Method of burning salt glazed ware. W. SCHUEN. *Tonind. Ztg.*, **54**, 454(1921).—Describes process as carried out by the author. WM. M. C.

5. Contraction of some quaternary (ceramic) mixtures fired to different temperatures. H. S. NEWMAN. *Trans. Ceram. Soc.*, **19**, 132-39(1919–20).—Slabs were prepd. from ball clay, china clay, stone, and flint in varying proportions, and some of each batch were fired in a saggar to cones 1*a*, 6*a*, and 8. Half were then dipped in a lead glaze and half in a leadless glaze and fired to cone 3*a*. The contraction at cone 016 was less in the majority of cases than the dry contraction, showing that at a certain temp. there is an expansion, probably due to the liberation of combined H_2O. Until the proportion of stone to flint falls below 3:2 the replacing of ball clay by china clay raises the contraction, and after this proportion is passed the reverse action takes place at the temp. of cone 1*a*. For cones 6*a* and 8 the proportion of stone to flint must be below 2:3 before the reversion occurs. The contraction does not always rise with the temp., but with some mixts. it reaches a max. and then falls again. The gradual substitution of one clay for the other, with the other materials remaining const., does not have a direct bearing on the contraction nor does the change from stone to flint while keeping the clays const. A large variation can be made in the proportions of ingredients used without affecting the working properties or causing crazing or peeling.

J. S. C. I.

6. Effect of added feldspar on the shrinkage and porosity of aluminous fireclays after being fired at high temperatures. E. M. FIRTH AND W. E. S. TURNER. *J. Soc. Glass Tech.*, **4**, 392–400(1920).—In a previous paper (*C. A.*, **14**, 3514) the authors had noted that, of clays which they examd., those of high Al_2O_3 content showed, with two exceptions, the widest range of porosity on firing. It is now shown that if 1 or 2% of feldspar is added to the two exceptional aluminous clays (to act as a flux during firing) the shrinkage is rendered more uniform, and there is a considerable increase of porosity range.

J. S. C. I.

PATENTS

7. Artificial meerschaum. P. DEUSSING. Brit. 164,319, May 25, 1921. Artificial meerschaum consists of Hallic earth, raw Meissner clay, whitening, and quartz dust. The Hallic earth may be replaced by roasted Meissner clay, and feldspar, MgO, or potash may be added to increase the flexibility of the mixt. The ingredients, after being separately pulverized, are ground together with H_2O into a semi-liquid paste which is cast in dry gypsum molds. After a few minutes, the still liquid portion is removed from the mold leaving a hollow casting, which is dried in the mold, roasted and oiled or waxed. An example of proportions is 30 pts. by wt. of Hallic earth, 10 of Meissner clay, 4 of whitening, and 8 of quartz dust, to which 50 pts. of H_2O are subsequently added. (*C. A.*)

Apparatus and Instruments

8. **The Tyndallmeter reading of soil dispersoids.** F. M. Scales and Franklin W. Marsh. Bureau of Plant Industry, U. S. Dept. of Agriculture, Washington, D. C. *Jour. Ind. Eng. Chem.*, **14**, 52–54(1922).—A method is described whereby the conc. of the colloid in a clay can be approx. and rapidly detd. by shaking up the clay with water, allowing it to settle and measuring the strength of the Tyndall beam. Ed.

9. **High temperature studies. XIII. The measurement of vapor pressures at high temperatures and the vapor pressures of alkali halides.** O. Ruff and Susanne Mugdan. *Z. anorg. allgem. Chem.*, **117**, 147–71(1921); cf. *C. A.*, **13**, 3054.—By measuring the loss in wt. of the substance held at temps. first slightly above that at which the phenomena of boiling are first noticed, and then at somewhat higher temps. and for different pressures, it is possible to det. the vapor pressure of solids at high temps. The temp. may be reached in a Heraeus furnace with Ni-wound tubes for temps., up to 1200° and in a C resistor furnace for high temps. Temp. is measured with an optical pyrometer for which calibration data are given. During the course of a detn. N is passed through the system at such a rate as to keep its pressure practically const. The container or boiling flask depends on the substance under examn.; for metals, which have a relatively high surface tension, it may be of porous C or graphite; for salts, which have a lower surface tension, optically opaque quartz (opaque at the temp. used) is better. For metals these containers should not have a capacity greater than 0.2 cc. while for salts 0.6–0.7 cc. is necessary. The method was checked up using previously obtained data on the vapor pressures of As, Sb, Bi, and Cu, all of which data are included in the article. Using this method then, the vapor pressures of the alkali halides were detd. The data cover from 7 to 9 points on the curve and the vapor pressure range is from 40 to 60 mm. up to the b. p. The heats of vaporization and the crit. temps. are calcd. Finally, a comparison is made between the obs. values and those calcd. by the Ramsay-Young rule; the latter is shown not to hold exactly. E. H. D. (*C. A.*)

Chemistry, Physics and Geology

10. **The swelling and gelation of gelatin.** Robt. H. Bogue. Mellon Institute, Pittsburgh, Pa. *Jour. Ind. Eng. Chem.*, **14**, 32–35(1922).—A study of the degree of swelling, viscosity, alcohol number and *pH* value upon gelatin mixed with sodium silicate, in which the ratio of Na_2O to SiO_2 was varied between 1:4 and 1:1. Ed.

11. **The transition of quartz into tridymite.** Pulfrich. *Tonind. Ztg.*, **45**, 1127–28(1921).—A summary of the observed facts regarding the influence of various substances upon the velocity of transition. Cf. *Jour. Am. Ceram. Soc.*, **4**, 421. H. G. Schurecht

12. **Some unsaturated silicon compounds.** H. Kautzky. *Z. anorg. allgem. Chem.*, **117**, 209–42(1921).—The action of HCl on $CaSi_2$ results in the

formation of a mixt. of 3 substances. In order to obtain them pure, the action of alc. HCl, contg. varying amts. of aq. HCl, was studied. Very dil. HCl contg. a large excess of alc. yielded a white, very little sol. cryst. substance of the compn. Si_2H_2O, to which the name *oxydisiline* is given. It has the following properties: Stable to 140°; at higher temps. it is decomposed into gaseous products readily inflammable in air; H_2O decomposes it slowly, more rapidly in heat or light, yielding a self-inflammable gas and H; alkalies and aq. NH_3 cause the reaction to become violent; dry NH_3 reacts above 0° to give nitrogenous compds. which with alc. yield org. Si compds.; it is a vigorous reducing agent—HNO_3 and H_2O_2 react explosively, H_2SO_4 is reduced to H_2S, P_2O_5 to PH_3 in the presence of alc. and many metals are precipitated from solns. of their salts. Treatment of well cooled Si_2H_2O, suspended in CS_2, with a dil. CS_2 soln. of Br gives the yellow compd. *silical bromide*, $(Si_2OH)Br$, so named because it is derived from the new radical, *silical* (Si_2OH). Oxydisiline can be converted into silical derivs. by the action of Cl, $CHCl_3$, CCl_4, C_2H_5I, aq. HCl, H_2SO_3. By hydrolysis of silical bromide, K. prepared dark brick-red *silical hydroxide*, $(Si_2OH)OH$, which is a base forming yellow, readily hydrolyzed *salts* such as halides, sulfate, phosphate, formate and acetate. No solvent for any of the silical compds. was found. These compds. can be oxidized to silicic acid, which is the third product referred to above. The supposed compd. "silicone" obtained by Wöhler (*Ann.*, **127**, 264(1863)) and by Hönigschmidt (*C. A.*, **4**, 30) as a result of the action of aq. HCl on $CaSi_2$ is undoubtedly a mixt. of the 3 substances isolated by K. Analytical and crystallographic data are given in some detail and it is pointed out that the oxydisiline, the silical compds. and finally the silicic acid are pseudomorphs of the original $CaSi_2$. The structures, $Si_2OH.H$ and $Si_2OH.X$, are proposed for the oxydisiline and the silical compds., resp., but it is suggested that the salts of the latter may be oxonium compds. of the type $Si_2O.HX$. For the unsatd. character of these Si compds. no satisfactory explanation is given; they may be analogous to compds. of bivalent C. E. H. Darby

(*C. A.*)

13. Indian bauxite. Anon. *Tonind. Ztg.*, **64**, 551, 552(1921); *Chem. Trade J. and Chem. Eng.*, **2**, 4, 441(1921).—Describes compn., occurrence, applications of bauxite. The Indian deposits were discovered in 1907, and promise to be an important source of pure bauxite in the world trade.

Wm. M. Clark

14. Binary systems of lithium orthosilicate with zirconium orthosilicate and with calcium orthosilicate. Robert Schwarz and A. Haacke. Freiburg i. B. *Z. anorg. allgem. Chem.*, **115**, 87–99(1921); cf. *These Abs.*, **1**, 6(1921).

15. Basic exchange in silicates. III. E. Ramann and H. Junk. *Z. anorg. allgem. Chem.*, **114**, 90–104(1920).—In continuation of previous work (*C. A.*, **11**, 2174; **14**, 256), the formation of Mg permutite by the action of Mg salts on NH_4, Na, and K permutites has been studied. As in other cases, the reaction is ionic, and there is no evidence of physical adsorption. Pure

Mg permutite could not be obtained, not more than half of the bases present in the original permutite being displaced by Mg. The whole of the NH_4 in NH_4 permutite could not be displaced by treatment with carnallite or kainite solns. Mixed salt solns., decompose the permutite to some extent, especially solns. contg. Mg or NH_4. This observation may have some bearing on the decompn. of natural silicates, which can not always be adequately accounted for by the action of water and H_2CO_3. J. C. S.

16. Corundum. A. L. HALL. Geol. Survey, *Mem.*, **15**(1920) (Dept. Mines and Industries Union of S. Africa); *Bull. Imp. Inst.*, **19**, 93–4(1921).—The Transvaal corundum deposits are said to be the largest and most important yet discovered. It is concluded from the geological relationships that the corundum has originated from an excess of Al_2O_3 occasioned by some of the SiO_2 in pegmatites of granitic origin being abstracted by the basic rocks into which the pegmatites have been intruded. R. L. S. (*C. A.*)

17. Magnesite. A. G. MAITLAND. W. Australia Geol. Survey, *Mem.*, No. 1; *Bull. Imp. Inst.*, **19**, 100–1(1921).—Analyses of 8 samples of magnesite from 5 different deposits in W. Australia show MgO from 44.31 to 47.36% and CO_2 from 47.76 to 51.69%. The magnesite is found on the surface as an alteration product of serpentinized rock. R. L. SIBLEY (*C. A.*)

18. Researches in the chemistry of the silicates. F. M. JÄGER AND H. S. VAN KLOOSTER. *Sprechsaal*, **52**, 256(1919); *J. Soc. Glass Tech.*, **3**, 234–6.—The silicates were prepd. by first heating a mixt. of quartz and the metal carbonate or oxide to the sintering point in an Ir-free Pt dish in an elec. oven, and then completing the fusion in a Fletcher gas furnace. The silicates of Ba, Sr, Be, Zn, and Cd were white and cryst.; that of Zn showed a blue to violet coloring, while those of Mn developed a brown color. In the following table are stated some of the properties of the silicates. n_1 and n_2 are the refractive indices for uniaxial crystals, and n_1, n_2, and n_3 for biaxial. It was found that the meta-silicates have m. ps. which are related linearly to the at. wts. of the metals, the m. ps. rising with increasing at. wts. in the case of Ca, Sr, and Th, and falling with Mg, Zn, and Cd.

Substance	M. p.	Sp. gr.	Refractive indices	Special remarks
$BeSiO_3$[1]	> 1750°	—	— — — —	———
$MgSiO_3$[2]	1554°	3.175	$n_1 = 1.641$; $n_2 = 1.648$; $n_3 = 1.663$.	———
Mg_2SiO_4	1750°	—	— — — —	———
$CaSiO_3$[3]	1540°	—	$n_1 = 1.609$; $n_2 = 1.650$.	———
Ca_2SiO_4[3]	2130°	3.27	$n_1 = 1.714$; $n_2 = 1.720$; $n_3 = 1.737$.	———
$SrSiO_3$[4]	1578 ± 1°	3.652	$n_1 = 1.620$; $n_2 = 1.590$.	The melt can be supercooled to 1225° when sudden rise of temp. to 1364° accompanied by crystn. takes place. By rapid cooling of the melt, an almost isotropic glass can be obtained with $n = 1.618$, sp. gr. 3.540, and by careful heating a micro-crystalline variety is obtained.
Si_2SiO_4[4]	> 1750°	—	— — —	
$BaSiO_3$[4]	1604°	4.435	$n_1 = 1.670$; $n_2 = 1.667$.	———

$BaSiO_4$[4]	1750°	—	—	Small, weakly double refracting crystals. Attempts to obtain the substance as a glass were unfruitful.
$ZnSiO_3$[4]	1437 ±1°	3.52	$n_1 = 1.623$; $n_2 = 1.616$.	
Zn_2SiO_4[4]	1509°	—	$n_1 = 1.719$; $n_2 = 1.697$.	Weakly double refracting crystals.
$CdSiO_3$[4]	1242°	4.928	Both > 1.739.	Crystals identical with *Willemite*.
Cd_2SiO_4[4]	1252–1243°	—	Both > 1.739.	Crystals with strong double refraction.
$MnSiO_3$[4]	1273 ±1°	3.716	$n_1 = 1.739$; $n_2 = 1.733$.	Crystals with strong double refraction.
Mn_2SiO_4[4]	1290–1300°	4.044	Both > 1.739.	Artificial *rhodonite*.
				Artificial Mn_2SiO_4 has no fixed m. p. Became dark colored on heating through decompn.
$CaMG(SiO_3)_2$[5]	1391°	3.275	$n_1 = 1.664$; $n_2 = 1.671$; $n_3 = 1.694$.	

[1] Observers: Jäger and van Klooster.
[2] Observers: Allen and Wright.
[3] Observers: Day, Allen, White, Shepherd and Wright.
[4] Observers: Jäger and van Klooster.
[5] Observers: Allen and White.

(*C. A.*)

19. The introduction of silicic acid into the nucleus of complex compounds. ROBERT SCHWARZ AND HANS BAUSCH. *Ber.*, **54**, 802–813(1921).—Among the more credible theories regarding the constitution of the Al silicates is that of W. Vernadsky, namely, that they are hydrates or salts of complex alumino-silicic acids. To cast light on the problem of the constitution of the *silicates*, the authors have studied the reactions of Na_2SiO_3 with complex compds. of known constitution, namely, hexamminocobaltic chloride, and chloropentamminocobaltic chloride. 1.25 g. Na_2SiO_3 in 50 cc. H_2O reacts with 2.5 g. $[Co(NH_3)_5Cl]Cl$ in 500 cc. H_2O to form *tetrasilicato-chloro-triammino-cobalt* $[Co(NH_3)_3Cl(Si_4O_9)]$. When dry, this is a reddish violet, fine, noncryst. powder. Heated at 120° it leaves marine-blue *cobaltous tetrasilicate*, $CoSi_4O_9$. It does not react with H_2O or cold dil. HCl, but hot HCl decomposes it, setting free all the SiO_2. Hot, strong NaOH soln. decomposes it with the sepn. of $Co(HO)_3$, which reaction was used in the quant. analysis of the compd. 50 cc. 2% soln. of Na_2SiO_3 and 2.5 g. $[CO(NH_3)_6]Cl$ in 500 cc. H_2O react forming a yellow-orange ppt. of *silicato-tetrammino-cobaltic chloride*, $[Co(NH_3)_4(Si_4O_9)]Cl$, which can be freed from small amts. of adsorbed H_2O only at 105° and with accompanying decompn. It is insol. in H_2O, is decomposed by dil. mineral acids, and even slowly by warm AcOH, setting free SiO_2. Heated, it decomposes according to the equation, $[Co(NH_3)_4(Si_4O_9)]Cl = CoSi_4O_9 + 4NH_3 + Cl$. Inasmuch as this silicato-complex is a cation, silicates of it should exist under suitable conditions. The reaction between 2.5 g. $[Co(NH_3)_6]Cl$ in 500 cc. H_2O and 2.5 g. Na_2SiO_3 in 50 cc. H_2O yields a yellow ppt. of *silicato-tetrammino-cobaltic silicate*, $[Co(NH_3)_4(Si_3O_7)]_2SiO_3$. This is the first synthetic silicato-silicate which has been prepd., and may be of interest in the interpretation of many reactions of the natural Al silicates. This compd. is decomposed by acids. When decomposed by heat, the product is not a simple substance. It was impossible to effect a sepn. of the Si within the nucleus from that in the SiO_3 anion. When the luteo-base, $[Co(NH_3)_6](OH)_3$, was treated with a suspension in H_2O of dioxo-disiloxane, $Si_2H_2O_3$,

there was formed the complex base, $[Co(NH_3)_4(Si_4O_9)]OH$, in which case the Si has entered the nucleus instead of forming a silicate with the complex as the cation. These facts add probability to the theory that many of the Al silicates are not silicates, but silicato-compds. in which Si radicals are coördinatively bound to the Al along with aquo–, oxo– and other groups, forming complex nuclei. The above compds. can be prepd. smoothly and free from by-products only by using cryst. Na_2SiO_3 and adhering strictly to the quantities and concns. specified in the article. R. H. LOMBARD (*C. A.*)

20. **Siliconhydrides X. Nitrogen-containing compounds.** ALFRED STOCK AND KARL SOMIESKI. *Ber.*, **54**, 740–58(1921); cf. *Jour. Am. Ceram. Soc.*, **4**, 1004.—The authors have studied the action of NH_3 on SiH_3Cl and SiH_2Cl_2. These reactions give N derivs. of monosilane which contain the groups SiH_3 and SiH_2, and many of which are volatile, simple mol. substances. These compds. form a new basis for the comparison of Si- with C-chemistry. Differences and similarities between the Si-N compds. and the analogous C-N compds. are discussed. *The preparation of* SiH_3Cl (b. p.—30°) *and of* SiH_2Cl_2 (b. p. 8°), which were used as starting substances in this research, is described. R. H. LOMBARD (*C. A.*)

21. **On plastic flow through capillary tubes.** E. BUCKINGHAM. *Proc. A. S. T. M.*, **21**, 1154–57(1921).—As the formula of Bingham and Green is only a very rough approx., the author math. develops the more exact formula for a steady flow through a long round tube and for the vol. rate of discharge. The effect on the vol. rate of discharge formula due to the introduction of Green's hypothesis of viscous slip is also given, together with a graph of the discharge curve. To reduce the importance of slip it is necessary to use large tubes. E. N. BUNTING

22. **A study of elastic viscous deformation.** P. G. NUTTING. *Proc. A. S. T. M.*, **21**, 1162–68(1921); *Frank. Inst. J.*, **191**, 679–85(1921).—A simple instrument which measures the force necessary to pull out a rod at a given rate from the mat. under investigation was used to study the viscous behavior of asphalt, stearine, pitch, hydrolene, and a mixt. of Tarvia X + MgO. It was found that the laws of viscosity ordinarily assumed did not in general apply, as the shearing strain is not in general proportional either to the shearing stress or to the time it is allied. The relation found to hold between stress s, time t, and stress or force F is given by $s = at^nF^n$, where a, n, and m are constants. This reln. includes as special cases relns. ordinarily assumed to hold for elastic solids ($n = 0$ and $m = 1$, Hooke's Law) and for viscous fluids ($n = 1$ and $m = 1$) and clears up the many difficulties and inconsistencies often encountered in viscosity measurements. Melting, softening, dropping, and other thermal points may be exactly defined by means of this new formula by assigning sp. values to any or all of the constants a, n, and m, while measuring s, t, and F in specified units. It is pointed out in the discussion, however, that the mats. investigated are plastic and that the laws of plastic bodies, which have not as yet been very well formulated, might not be the same as the viscosity law. E. N. BUNTING

23. An elutriation test for potters. B. Moore. *Trans. Cer. Soc.*, **20**, 112–19(1921).—The app. is a one-can elutriator of the Shöne type with straight side and a cross-section of 34.47 inches so that a flow of one pint per min. gives a velocity of one inch per minute. The author believes the mean diam. of the coarser particles in elutriation tests have been estimated too high and consequently the surface factors have been too low. Emphasis is laid on the known fact that the sp. gr. of the mat. being elutriated is an important factor in detg. the size of particles that will be carried by a stream of given velocity.
H. F. S.

24. Silica in 1920. L. M. Beach. U. S. Geol. Survey, *Mineral Resources of U. S., 1920*, Part II, 151–2(preprint No. 17, published Oct. 11, 1921). E. H. (*C. A.*)

25. Crystalline magnesite at St. Martin, Salza. Franz H. Ascher. *Z. prakt. Geol.*, **1917**, 66–9.—Pure, cryst. magnesite occurs at St. Martin on the Salza, 4 km. from Öblarn in Obersteiermark. Analyses of the mineral are given. It occurs in a bed averaging 15–20 m. thick and extending over a distance of 1100 m. E. F. Holden (*C. A.*)

26. Mineral resources of the state of New York. David H. Newland. *N. Y. State Mus. Bulls.*, Nos. **223, 224**, 307 pp.(1919).—"This report is intended to serve the purpose of a general guide to the mineral resources of New York. It presents the principal facts regarding the character, occurrence and production of the useful minerals, with reference to particulars of the local features that bear upon their industrial utilization." For the year 1918 the value of *Portland cement, brick, pottery, other clay products, gypsum*, Fe ore, natural gas, petroleum, salt, sand and gravel other than molding sand, and limestone was over $1,000,000 each; the range being from 1.4 to 7.3 million dollars. The value of garnet, *graphite*, mineral waters, pyrite, *molding sand*, marble, sandstone, trap, granite, *talc*, and Zn ore ranged from $135,000 to $902,000. The total value of the mineral products for 1918 was over 54 million dollars. More than 100 chem. analyses of various mineral samples are recorded. L. W. Riggs (*C. A.*)

27. Feldspar. Arthur S. Watts. *Mineral Ind.*, **29**, 226–27(1920).—Production figures and a list of grinding mills are given. A. Butts (*C. A.*)

28. Garnet. D. H. Newland. *Mineral Ind.*, **29**, 10–11(1920).—A discussion of the sources, use, market and production of abrasive garnet.
A. Butts (*C. A.*)

PATENT

29. Soluble silicates. F. J. Phillips. Brit. 163,877, April 9, 1920. Sol. silicates of high SiO_2 content are prepd. by dissolving silicic acid in alkali silicate solns. obtained by fusing SiO_2 and alkali, or SiO_2, alkali, and borax, and treating the cooled and broken melt with H_2O. The silicic acid is prepd., *e. g.*, by adding H_2SO_4 to cold water-glass soln., and after dialysis is dissolved in the silicate soln., by continued griding or agitation. Cf. 151,508 (*Jour. Am. Ceram. Soc.*, **4**, 317) and 151,399 (*C. A.*, **15**, 2699). (*C. A.*)

Refractories and Furnaces

30. **Report of Committee C-8 on refractories.** R. C. Purdy and W. H. Fulweiler. *Proc. A. S. T. M.*, **21**, 315–16(1921).—The present tentative method for ultimate chem. anal. of chrome ores and chrome brick has been adopted as standard by the Society. A proposed method of test for resistance of fire-clay brick to spalling action has been adopted as tentative. Investigation of conditions under which refractory mat. are used in the steel industry is practically completed. A study on microstructure is also under way. E. N. Bunting

31. **Tentative method of test for resistance of fire-clay brick to spalling action.** Anon. *Proc. A. S. T. M.*, **21**, 577–78(1921).—The object of the test is to detn. the resistance to spalling action by subjecting the brick to repeated rapid temp. changes. Instruction for the prepn. of samples and the detailed procedure are then given. E. N. Bunting

32. **Refractory brick for blast furnaces.** Anon. *Brit. Clayworker*, **30**, 3(1921).—The brick should meet the following requirements: (1) resist. to abrasion, (2) resist. to the chem. action of slags, metals and gases, (3) resist. to high heat and (4) resist. to sudden temp. changes. The fire boxes and bottom of the furnace should be lined with brick having the compn. 63% Al_2O_3 and 37% SiO_2 and should be fired at 1300° C. H. G. S.

33. **The importance of air supply in combustion of coal.** Henry Kreisinger. *N. J. Ceramist*, **1**, 39(1921).—A general discussion of the processes of combustion and their control in the opern. of hand-fired furnaces. C. W. Parmelee

34. **Application of coal in burning brick.** J. Weiss and Dr. Ing. H. Becker. *Tonind. Ztg.*, **48**, 396, 397; also **56**, 469, **58**, 491(1921).—Describes many different types of ring furnaces with illus., and their advantages and efficiency. Wm. M. Clark

35. **Short and long flames in gas firing.** M. Kruss. *Tonind. Ztg.*, **53**, 443(1921).—Concludes that short flames result when gas and air are instantaneously mixed at the burner and long flames when a gradual mixture of gas and air takes place. Wm. M. Clark

36. **Unburned fire proof blocks.** Paul Schneider. *Tonind. Ztg.*, **49** 405, 406; also **52**, 434, **54**, 452, 453, 454(1921).—Detailed description of expts. with different mixts., influence of sizes of ingredients and effect of CaO, SiO_2, etc. Wm. M. Clark

37. **Electric furnaces for melting glass.** O. Maetz. *Chem. Zentrblt.*, **25**, 709(1920); and *Sprechsaal*, **53**, 420(1920).—Describes arc type furnaces used in Sweden by A. B. Elektriska, Ungar, Stockholm. Wm. M. Clark

38. **Sintered dolomite.** Anon. *Tonind. Ztg.*, **53**, 492(1921).—Description of the dead burned product and amount of bond required. Concludes that for the Siemens-Martin Steel Furnace the best sintered dolomite contains 3% Al_2O_3 and Fe_2O_3 and 2.5% SiO_2. Wm. M. Clark

39. **Extraction of calcium oxide from calcined magnesite.** L. H. Duschak. *Chem. Met. Eng.*, **23**, 628(1920).—CaO may be almost completely

extd. from magnesite after calcining at 900°–950° by leaching for several hrs. with water free from CO_2. If the magnesite has been calcined at higher temps., and especially if it is "dead burnt," the extn. is very incomplete and is not improved by fine grinding probably owing to the formation of an insol. compd.
J. S. C. I.

40. Electric-furnace purification of zirkite. J. G. Thompson. *Trans. Am. Electrochem. Soc.*, **40**, preprint(1921).—Zirkite ore was treated in elec. furnaces to remove the Fe, Si, Ti, and other impurities usually associated with it. It was found that the temp. required was too high for a resistance furnace. With an arc furnace 90–95% of the Si could be removed by heating the ore to 2220° or higher, provided coke was added in just the proper amt. to transform only the Si to carbide. The existence of stable double carbides of Si and Zr, or of solns. of SiC in solid ZrC, is suggested as an explanation of the incomplete removal of the Si when an excess of C is present. The further treatment of the ore with Cl or $COCl_2$ to remove the Fe is suggested.
W. E. Ruder (*C. A.*)

41. Investigations of zirconium with especial reference to the metal and oxide. J. W. Marden and M. N. Rich. *Bur. Mines, Bull.* **186**, 146 pp. (1921); cf. *Jour. Am. Ceram. Soc.*, **3**, 765.—The work is divided into four parts, dealing successively with an historical review of Zr minerals, the salts of Zr, and the metal; exptl. work on Zr; the furnaces used; and a bibliography of Zr and its compds. Analytical methods are given for detg. Zr in ferrozirconium, steel, alloys such as Ni-Zr, and a method of sepn. of Ti, Cb, Ta and Zr. The phys. and chem. properties of amorphous and coherent Zr are fully listed. The cupferron method is the only one effecting complete sepn. of Zr and Al. W. H. Boynton (*C. A.*)

42. The possibility of preparing high-grade silica bricks from quartzite rock. E. Lux. *Stahl u. Eisen*, **41**, 258–64(1921).—Good silica brick can be made from quartzite rock provided a sufficiently high burning temp. is used.
R. S. Dean (*C. A.*)

43. Physical characteristics of specialized refractories. IV. M. L. Hartmann and W. A. Koehler. *Trans. Am. Electrochem. Soc.*, **40**, preprint (1921); cf. *Jour. Am. Ceram. Soc.*, **3**, 582; *ibid.*, **4**, 239; *ibid.*, **4**, 165.—The cross breaking strength of each of 10 refractories was detd. at 20° and 1350°. Within this temp. range chrome brick showed the most decided drop in modulus of rupture followed by bauxite, MgO, fire clay and SiO_2. Chrome bricks at 1350° have a breaking strength $^1/_{63}$ of their cold breaking strength. Two bonded SiC refractories showed an increase, indicating that the decrease occurs at a higher temp. than 1350°. W. H. Boynton (*C. A.*)

PATENTS

44. Dolomite bricks. C. H. Breerwood. U. S. 1,380,701, June 7. Dolomite contg. a small amt. of Fe is ground very fine, burnt at a temp. sufficiently high to vitrify or amalgamate it, finely reground, compressed under high pressure and burned to form a vitrified brick adapted for lining kilns or steel furnaces.

45. **Furnace linings.** C. H. Breerwood. U. S. 1,380,700, June 7. A refractory material suitable for lining furnaces or for making crucibles is prepd. by introducing dolomite and Fe or similar material adapted to form a sinter in a finely divided condition into a furnace, mixing with it small pieces of coal tar, Fe, fire brick or other material to which the finely divided material adheres in its passage through the furnace to form balls, and continuing the heating for a sufficient time to aggregate the materials to the desired extent.

46. **Electric furnaces.** Morgan Crucible Co., Ltd and C. W. Spiers. Brit. 162,246, Oct. 7, 1919. Resistance tubes or crucibles are sepd. from a refractory outer wall by natural graphite in the form of flakes, which may be got by grinding the graphite and freeing it from dust; graphite of high C content should be used. Such flaky graphite, if loosely packed, has low elec. and thermal conductivity and is sufficiently elastic to allow expansion and contraction of the crucible, etc. Around the cooler part of the crucible, from the bottom terminal to a point within the casing, there may be placed a fine powder, such as sand or finely ground earthenware, to insulate the graphite from the terminal.

47. **Automatic temperature control device for electric furnaces.** A. L. Wilkes. U. S. 1,377,952, May 10.

48. **Electric resistances.** W. Travis, T. H. Watson and Co., Ltd. Brit. 163,727, Aug. 13, 1919. A resistance for an elec. furnace is protected against oxidation by a casing consisting of bonded and fired SiC or of fused Al_2O_3. The core may consist of a series of disks, plates, rings, etc., or powder or granules, of amorphous or graphitic C or carbonaceous material. It may be placed in a mold and a mixt. of powdered or granular carborundum and clay rammed around it. Heat may then be applied externally, or elec. current passed through the resistance, to form it into a solid mass. The mixt. may alternatively be applied as a paste, or may be separately molded to form the casing. (*C. A.*)

49. **Refractory composition.** H. H. Buckman and G. A. Pritchard. U. S. 1,375,077, Apr. 19. In the prepn. of refractory articles such as furnace linings, muffles or the like, zircon is used with a clay binder.

50. **Refractory material.** M. L. Hartmann. U. S. 1,376,091, Apr. 26. A refractory material is formed of carborundum with Zr silicate and Al silicate as bonding materials.

51. **Refractory heat-insulating material.** P. G. Willetts. U. S. 1,374,538, Apr. 12. A refractory material adapted for boiler settings or the like is formed by burning a mixt. of finely divided lignite coal and plastic fire clay having a high silica content.

See Abstract No. 25.
See Abstract No. 103.

Abrasives

52. **Manufacture and use of coated abrasives.** L. S. Greenleaf. *Tech. Eng. News*, 2, 116–17(1921). Ed.

53. Artificial corundum. ANON. *Tonind. Ztg.*, **45**, 1135–36(1921).—In 1894 E. Moyat first made artificial corundum for the firm of Mayer and Schmidt. This mat. was free from many defects of the natural corundum and soon became widely used as an abrasive. About the same time Acheson discovered carborundum which also became popular as a refractory. The Moyat process for the manuf. of artificial corundum (Ger. pat. 85,021, 1896, class 12) was based upon the elec. melting of emery, bauxite, etc. and the reduction of impurities as Fe_2O_3, SiO_2 and TiO_2 with coal or charcoal. Al_2O_3 is not reduced by this process while the impurities are and as a result the impurities are reduced, float to the top and are easily picked off. The purified Al_2O_3 crysts. to brown to ruby crystals on cooling. During the war the production of this mat. became an important industry in Germany where it is known as "corraffin." H. G. SCHURECHT

See Abstract No. 119.

Stoneware, Whiteware and Porcelain

54. A method of determining the tensile stregth of porcelain. F. H. RIDDLE AND J. S. LAIRD. *Proc. A. S. T. M.*, **21**, 1050–56(1921).—Test specimens of two types, one with conical ends or shoulders, the other dumb-bell shaped, having cross-sections of 0.125–0.2 sq. in., were tested in an ordinary 2000-lb. Olsen cement testing machine provided with special grips. The specimens were prepd. by pugging and extruding rolls of suitable size, throwing rolls by hand, and by cutting large pugged and cast blocks. Different strengths were found for specimens prepd. in different ways and for comparative tests the specimens must be prepd. in a uniform manner. The specimens were glazed and burned in regular porcelain kilns. Warped specimens gave unreliable results. It was found that good triaxial porcelain has a tensile strength of 3000–6000 lbs. per sq. in., calculated from the breaking strength of specimens 0.4 in. diam. Special high temp. porcelains show strengths up to 10,000 to 12,000 lbs. per sq. in. It was found that the tensile strength is a function of the diam. and cross-section of the test specimen. Plotting breaking strengths against diam. of test specimens gives practically a straight line, expressed by the equation $S_1 = (d_1 - 1/4)\ \frac{S_2}{d_2 - 1/4}$, where S_1 = strength of specimen; d_1 = diam. of specimen; S_2 = strength of small test specimen; and d_2 = diam. of small test specimen. E. N. BUNTING

55. The firing of stoneware. S. E. *Keram. Rundschau.*, **29**, 401–402 (1921).—When CaO is present in stoneware bodies Ca compds. of low viscosity are formed and hence the bodies may deform easily at high temps. Mg compds. are more viscous and hence bodies contg. Mg do not deform as easily as those contg. Ca. For this reason bodies contg. considerable CaO can not be fired above cone 4*a*, while stoneware contg. feldspar instead can be fired to cone 9 or 10 without danger of warping. Stoneware clays should vitrify between cone 07*a* and 4*a*. The glaze should have a softening point

between cones 01*a* and 05*a* and should be basic or neutral. The basic glazes are not affected by sulphates as the acid are. It is advisable to avoid the use of fuel containing sulphates since sulpho silicates are formed with them causing the glaze to become dull. Finishing the burn with wood fuel instead of coal will remedy to some extent the ill effects of sulphates. H. G. SCHURECHT

56. Some unsolved problems in potting. ASHLEY MYOTT. *Trans. Cer. Soc.*, **20**, 39–46 (Presidential address).—Suggests need for more uniform quality in raw materials, for some new type ol filter press pump that would give continuous pressure, and for standardization of cylinder grinding. Suggests the use of producer gas and fuel oil for firing, the reuse of old plaster, the development of an automatic casting process for cups, etc., the publication of an elementary treatise on firing, the printing of underglaze colors, the introd. of a size for lithography which can be gilded upon without defects becoming apparent on the gilt decoration, and the more general use of mech. transport. States that in his own plant the loss between clay shop and packing room has never been less than 16%, exclusive of seconds and thirds.

H. F. S.

57. Recent visit to some Spanish and Portuguese potteries. W. LINDLEY. *Trans. Cer. Soc.*, **20**, 72–82.—In the large pottery of Gilman, Ltd., located at Sacovem and devoted to making whiteware, neither flint nor Carnish stone are used, the body consisting of silica sand, feldspar and a very slight admixt. of china clay and ball clay. Practically all the ware has been fired for the last 10 yrs. in a car-tunnel kiln of the Faugeron type. This kiln has no muffle and the ware is fired in saggers with the use of wood as fuel, which seems especially suitable for this type of kiln. The kiln is 275 ft. long. A temp. of 1150°C is used for biscuit and 1050°C for glass. Saggers do not last as long in the tunnel kiln as in beehive kilns. The underglaze printed patterns were not "hardened on" but the oil was neutralized by the use of weak sulphuric acid. A leadless glaze was used with very good results. Tiles to be glazed were placed on a traveling belt which carried them under a coating roller which imparted just the requisite amount of glaze without smearing the sides. A "climax" kiln has been used as long as 15 months before having to be shut down for repairs. H. F. S.

58. Effect of calcination of flints on earthenware bodies. A. HEATH AND A. LEESE. *Trans. Cer. Soc.*, **20**, 121–126.—Keeping the wt. per pint of slop flint the same, the wt. of dry flint content may vary 12.8 %. This is due to the fact that the sp. gr. of the flint may vary from 2.6 to 2.2, according to the degree of calcination. When sand is used in pottery making in place of calcined flint, the biscuit firing must be carried to a higher temp.

H. F. S.

59. Thorpe's solubility ratio. J. W. MELLOR. *Trans. Cer. Soc.*, **20**, 120.—T. E. Thorpe proposed an empirical rule which gives a fair indication whether a lead frit is likely to have a low soly. The rule should read

$$\frac{\text{Sum of bases (including alumina)}}{\text{Sum of acids}} = 0.5 \text{ approx.}$$

where molecular proportions (bases unity) are understood. Thorpe's suggestion that the number be multiplied by the mol. wt. of lead oxide and divided by the mol. wt. of silica is quite arbitrary and unnecessary.

H. F. S.

60. Some notes on saggers. B. J. Moore. *Trans. Cer. Soc.*, **20**, 93–104.—Carborundum used as grog gave saggers with long life. The objections to the use of such saggers were: excessive cost, development of small cracks in the first firing, and excessive boiling when used with clays containing pyrites. They give better results in oxidizing than in reducing kiln atms. The author has used fused quartz, costing 50s per ton, as grog on a factory scale with great success. The clays used have been mixtures of ball and china clay, the relative percentages depending on the temperature. Saggers containing fused quartz as grog have a dull ring but do not dunt. The duller the ring, the longer they last. They do not stand rough handling well. Used in china biscuit oven, they have stood over 70 firings. H. F. S.

61. Further recent improvements in Swedish potteries. A. S. W. Odelberg. *Trans. Cer. Soc.*, **20**, 47–55.—A lecture, illusd. by moving pictures, covering equipment discussed in a former article (cf. *These Abs.*, **1**, 12). New points are: all china clay used is imported from England. Cylinder grinding has been employed for 30 yrs. Biscuit ovens are fired $^2/_3$ with coal and $^1/_3$ with wood. Wood alone could be used but the cost for labor would be higher, the flame would be reducing and the life of the saggers shorter. The kiln bats used in the enamel oven are made of fire clay while those generally used in Staffordshire are made of iron. During the summer saggers are dried in open sheds. H. F. S.

62. Stoneware machines, pumps and exhausters. Fr. Müller. Friedrichsfeld. *Z. angew. Chem.*, **34**, Aufsatzteil, 291–2(1921).—A general paper read at the meeting of the Ger. Chem. Soc. in Stuttgart. J. H. Moore (*C. A.*)

63. Moissen porcelain for pottery and chemical ware. W. Funk. *Z. angew. Chem.*, **34**, Aufsatzteil, 127–8(1921).—Klein (cf. *C. A.*, **11**, 287) concluded from a microscopic study that Royal Meissen porcelain was burned at a comparatively low temp. or heat treatment. Funk claims this to be erroneous.

C. H. Kerr (*C. A.*)

PATENT

64. Manufacture of hard porcelain for chemical and electrical purposes, etc. Otogorô Umeda. Japan 37,175, Sept. 28, 1920. Minerals partly or mainly composed of $MgSiO_3$, whose hardness is above 4, *e. g.*, enstatite, diopside, tremolite, jade, forsterite, serpentine, are mixed with clay of high purity. The operation is conducted as usual. (*C. A.*)

See Abstract No. 23.

Glass

65. Stained and painted glass. C. J. Connick. *Tech. Eng. News.*, **2**, 107–108(1921). Ed.

66. The Canadian glass industry. Anon. *Can. Ind. of Chem.*, **V**, 315(1921). —The products of the Canadian glass industry in 1918 were valued at the

factories at $6,578,602, while imports into Canada for 1918 of glass and glassware were valued at $5,430,873, exports amounting to $35,267. Nine plants were engaged in the manuf. of glass and glassware in Canada in 1918, with a total working capital invested of $7,443,525. The industry employed 2,215 workers. The industry used $2,056,739 of materials during the year, of which the chief items were: soda ash $635,068; limestone $18,076; lime $18,046; litharge and red head $17,764; arsenic (white) $8,694; boxes and cases $367,946. The production of the industry included lamp and lantern chimneys, tumblers, bottles, and other pressed and blown glassware made by six firms; phials and chem. glassware by two others; and window glass by 1 firm only. Of the glass imports the largest item is for common and colorless window glass $1,809,031; plate glass $1,031,440; carboys, decanters, flasks, jars and phials, $657,113.

ED.

67. **The manufacture of constructional glass in the United States.** E. WARD TILLOTSON, JR. *J. Soc. Chem. Ind.*, **40**, 155–9T(1921); *Nat. Glass Budget*, **37**, No. 16, 1–7(1921).—Descriptive of the Lubbers and Colburn processes for the mechanical production of window glass, and of the manuf. of plate, wire, and miscellaneous sheet glass. At present about $1/3$ of American window glass is still hand made. The Colburn machine is producing about $1/4$ of the total window glass requirements. By this method sheets of any thickness up to $1/4$″ can be drawn continuously, and it becomes a competitor in the plate glass industry as well as in the window glass. J. B. PATCH (*C. A.*)

68. **The manufacture of iridescent glass.** OTTO WILHELM. *Diamant*, **42**, 601–602, 619–20(1920); *Glass Industry*, **2**, 85–6(1921).—Glass may be made iridescent by either the wet or dry method. The former procedure subjects the glass to the action of 20% HCl at 120° under a pressure of 5 atms. In the dry method the glass is heated in a muffle and exposed to vapors of Sn chloride mixed with carbonates and nitrates of Sr, Ba and Cu according to the effect desired. Soft Pb and Na glasses give the best results.

J. B. PATCH (*C. A.*)

69. **A new method of coating pearl beads.** O. PARKERT. *Sprechsaal*, **52**, 23, 191(1919); *J. Soc. Glass Tech.*, **4**, 25–6.—Older methods of coating "pearl" beads were unsatisfactory on account of the ease with which the coating was rubbed off. Better results were obtained by coating the beads with hard varnish contg. the "fish silver," but the surface lacked the brilliance of the fire-polished glass. The present process suggested a method for producing the coating on the inside of the beads, thus being protected from abrasion. In the new method, a soln. was prepd. from dry "fish silver," copal varnish, mastic and acetone, possessing the property of rapid drying. The crystal glass beads were cleaned thoroughly with soda and dried. They were then placed in a glass bowl, so arranged and mounted that it could be rotated rapidly about an inclined axis. A portion of the soln. as above was added, the container closed by a rubber cover, and then rotated. After a short period the interior of the glass "pearls" was found to be coated evenly and regularly with the pearl silver, but the excess soln. was contained in the interior of the

beads as drops of liquid. To remove this, the cover of the vessel was taken off and the speed of rotation doubled, the vessel being gently warmed by a small flame. In a short time the liquid was evapd., and the coating adhered firmly to the inside of the beads. Aniline colors and lusters could be applied as interior coatings to beads in a similar manner. Cf. *C. A.*, **15**, 1976.

H. G. (*C. A.*)

70. The causes of loss in bottles during pasteurization and sterilization. A. W. Bitting. *Glass Industry*, **2**, 171(1921); *Glassworker*, **40**, No. 39, 21 (1921).—Mfrs. reported losses ranging from 0.1 or 0.2 to 3%. The Research Dept. of the Glass Container Association made tests on bottles of various sizes from 4 to 64 ounces capacity. The amount of head space or excess volume over rated capacity was found to vary disproportionately. With the smaller bottles the head space was about 12% of the total capacity, but with the 64-ounce bottles the head space was less than 5%. This extra vol. should be made dependent upon the expansion of the materials used where the containers are to be subjected to heat. The bottles were filled with tap water at a temp. of 60°F. When they were heated to a temp. of 100° the water had expanded 0.7%; 140°, 1.5%; 180°, 2.6%; 190°, 3.0%. The breakage was found to be much less in the case of the small bottles owing not only to the lower pressure generated (because of the relatively larger head space) but also to the fact that small bottles are inherently stronger than large ones. Tap water containing air gave a different result from boiled water. This would indicate a difference in pressure generated between processing cold fruit juices and those which had been previously heated in a kettle. It was recommended that bottles be preheated to 120°F or more before capping. J. B. Patch (*C. A.*)

71. Some calculations of glass technology. J. B. Krak. *Glass Industry*, **2**, 159–60(1921).—Very clear directions are given for figuring a batch from a glass analysis and *vice versa*. A useful table of factors is appended.

J. B. Patch (*C. A.*)

72. Heat transfer in tanks. Henry W. Seldon. *Nat. Glass Budget*, **37**, No. 10, 1–5(1921).—A disscussion of the combustion of producer and coke-oven gases, and of flame temp. J. B. Patch (*C. A.*)

73. German sources of silica useful in the glass industry. Hugo Kühl. *Gashütte*, **51**, 340–1, 389(1921).—K. gives 77 locations and analyses.

J. B. Patch (*C. A.*)

74. New method of setting regenerator chambers. G. Suchy. *Sprechsaal*, **52**, 247(1919); *J. Soc. Glass Tech.*, **4**, 165–6.—S. continued a discussion on the subject of regenerator chambers in which the checker work was built up on a series of carriages which could be withdrawn and replaced at will. The idea was not new but had never met with general acceptance. In the usual type of furnace—if the dampers were closed during filling-in and correctly regulated during founding, so as to avoid excessive draught—batch dust would not be drawn into the regenerators, and their subsequent stopping up or collapse would be hindered to such an extent that resetting should not be necessary for 1 to $1^1/_2$ yrs. After this period the regenerators should be

reset entirely. In a tank furnace conditions were different. Batch was filled in at hourly intervals and dampers were rarely altered, so that much more batch dust was drawn into the regenerators. The "new" system might be of advantage under these conditions, but as the chambers would have to be reset along their length the process would be very disagreeable. Glass from the siege could be prevented from leaking into the regenerators to a great extent by paying particular attention to the covering of the chambers. As the furnace grew older, however, cracks developed, and some glass frequently found a way into the chambers. To avoid this as far as possible, the following procedure was recommended. Before the first pot setting rake over the siege a dry mixt. of $^2/_3$ quartz sand and $^1/_3$ plastic clay to fill up all cracks. At each subsequent pot setting fill up all cracks or channels with the same mixt. made into a slip with water, and then cover with a liberal coating of sand. In this way the siege remained intact, and glass could not leak through. Soft glasses, such as the more fusible lime-soda glasses, could usually be made in furnaces depending chiefly on top heating, but for harder glasses, such as Bohemian crystal, bottom heat was essential. This could be attained by correct furnace practice. For instance, in the improved Siebert furnace, where the regenerators were close under the furnace, so soon as the second filling-in had melted down, the dampers should be lowered. The heat was driven upwards from regenerators and under-furnace, and the flames became clearer, and a steady, successful found resulted. Overflowing from the glass pocket into the chambers could be prevented by closing the pocket with a fire-clay stopper luted lightly with fire clay. When the glass pocket became too full, the fluid glass forced out the stopper and flowed into a special pit, thus obviating the arduous work of drawing the glass from the pocket. S. agreed that elliptical regenerator blocks were preferable to the ordinary form, but from experience preferred blocks 32 × 10 × 10 cm., on the ground that they distributed the heat more uniformly throughout the chambers.

H. G. (*C. A.*)

75. The new method of setting regenerator chambers. J. Baldermann. *Sprechsaal*, **52**, 363(1919); *J. Soc. Glass Tech.*, **4**, 166.—B. maintained that the system of setting regenerator chambers by means of movable carriages had proved efficient in practice. For each chamber 3 carriages were necessary, and all 4 chambers could be reset in 2 to 3 hrs., whereas in the case of badly fused chambers it took from 48 to 60 hrs. to put these into good order by the older method. With regard to other points raised in the discussion, the siege of the furnace could be maintained in much better condition by the use of grog than by using the sand-clay mixt. recommended by Suchy (preceding abst.), since well burned grog was not so readily attacked by the overflowing glass as were sand and clay, and consequently remained permanent, whereas sand and clay were dissolved by the glass, leaving exposed cracks and channels in the siege. Further, the pots did not bind so firmly to the siege when set on coarse grog as when sand is used. In a furnace with top-flame heating it was quite possible to melt a glass contg. 30 parts of soda to 100 parts of sand, or

even somewhat harder. The harder the glass the cheaper it was and the better the color. B. pointed out that if the dampers were closed during filling in the result would be that the flame would be driven out through the filling-in holes. He approved the idea of the automatic emptying of the glass pocket, but it remained to be seen whether this would work out well in practice.

H. G. (*C. A.*)

76. The simplex muffle leer. C. E. Frazier. *Nat. Glass Budget*, No. 2, 1(1919–20); *J. Soc. Glass Tech.*, 3, 267–9(1919); 2 figs.—The advantages of muffle *vs.* open leers are enumerated. The Simplex muffle leer is an improvement over other muffle leers owing chiefly to a flat rather than a curved arch. This construction is made possible by use of a cast iron support for the tiles so that each tile has only its own weight to support, reducing breakage and by making thinner walls possible increasing the amount of radiation and thereby the efficiency of the leer.

J. B. Patch (*C. A.*)

77. Furnace for revolving pots. Anon. *Nat. Glass Budget*, 37, No. 21, 1–2(1921).—A description of a test of a Chapman-Stein recuperator applied to an Owens revolving pot. The temp. of the waste gases entering the recuperator was 1550°F. The temp. of the air coming from the recuperator was 1300°F. The temp. of the gases entering the stack was 650°F. If the distance between the furnace and recuperator had been less the initial temp. of the waste gases would have been higher; nevertheless the figures show the efficient transfer of heat of the waste gases to the incoming air. The recuperator is said to be capable of maintaining a very const. temp. For 24 hours the temp. readings of the furnace showed a max. variation of 40° F from the mean temp. However, this is not nearly as close a regulation as is possible and not even as close as the engineers guarantee. In another test under different circumstances a max. variation of ±10°F was obtained. The Stein recuperator is said to be especially valuable in connection with pot furnaces. In Europe it has not only reduced the fuel consumption of such furnaces nearly 1/2 but it has also nearly doubled the av. life of the pots.

J. B. P. (*C. A.*)

78. The Mathews reverberatory furnace. Anon. *Nat. Glass Budget*, 37, No. 18, 1, 20–21(1921).—A detailed description without diagrams of a recuperative gas-fired pot furnace, largely in the language of the patent

J. B. Patch (*C. A.*)

79. Comparative strength of prescription bottles. A. W. Bitting. *Glass Ind.*, 2, 187(1921).—The results of tests upon 28 sizes and types of prescription ware of 1/2 to 16 oz. capacity are tabulated. The data include height, cross-section, cubic displacement, weight, capacity, ratio of wt. to capacity, vertical resistance, lateral resist., hydrostatic resistance, impact resistance, max. and min. thickness. In the strength tests, the round bottles were the best except that the panel shaped bottles had the highest resist. to lateral pressure. The sq. bottles were among the weakest in all tests except in the resistance to hydrostatic or internal bursting pressure in which the ovals were the poorest. Classed as to size the large bottles offered the best resist. to vertical pressures

and the small bottles to hydrostatic pressure. The lateral and impact resist. were very uniform for all sizes. All of the bottles tested were the product of one firm. J. B. PATCH (*C. A.*)

80. **Flask calibrating and marking device.** G. L. SPENCER. *J. Ind. Eng. Chem.*, **13**, 1058–9(1921); 1 cut.—The meniscus is accurately located by means of a pair of Pt electrodes, which extend into the flask to just above the surface of the distd. water. The latter, slightly acidified with H_2SO_4, is measured into the flask with a calibrated burette. The visible or audible evolution of gases at the surface indicates the point of contact. A graving tool whose point has previously been aligned with the bottom of the central electrode is revolved about an axis in line with the center of the flask, cutting a ring in the wax coating. A 1. flask with a neck 20 mm. in diam. can be graduated to 0.02 cc., the limit of accuracy of the burette. Results are given for a series of flasks so graduated. T. F. BUEHRER (*C. A.*)

81. **Annealing of glassware—past, present, future.** E. E. MILNER. *Nat. Glass Budget*, **37**, No. 28, 1–4(1921); 7 illus.—Historical and descriptive of the Dixon muffle leer. The muffle chamber is made up of 10 flue units, the first 4 in front being heated by the initial combustion of gases and the 6 rear flues utilizing the waste heat from the front flues. Leers up to 20 ft. in width are made to compare favorably in temp. distribution and fuel consumption with those of less than half that width. This is accomplished by narrowing the flue areas, thus increasing the velocity of gases and flame length. Provision is made for the introduction of elec. heating elements into these flues, this being the annealing method of the future. The following temps. are given as being typical in the case of machine-made fruit jars: Tank furnace 2200° F, mold 600°F, plunger 800°F, outer surface of jar as taken from mold 600°F, inner surface 700°F, interior of thick wall or bottom 1400°F. To relieve the strains set up by these varying temps. 1050°F is given as a suitable leer temp. No cooling rate is given. The Dixon Strain Finder is briefly discussed with illus. J. B. PATCH (*C. A.*)

82. **Influence of silica on the annealing temperature of glass.** S. ENGLISH, F. W. HODKIN, C. M. M. MUIRHEAD AND W. E. S. TURNER. *J. Soc. Glass Tech.*, **4**, 387–91(1920).—S series of simple Na silicate glasses ranging from $2Na_2O.4SiO_2$ to $2Na_2O.10SiO_2$ was examd. The upper annealing temp. was found to rise with increase of silica content, the rate of increase being most rapid between $2Na_2O.4SiO_2$ and $2Na_2O.7SiO_2$. J. S. C. I.

83. **The effects of treating glass surfaces with certain lubricants.** W. SHACKLETON. *Trans. Optical Soc.*, **20**, 155(1919); *J. Soc. Glass Tech.*, **3**, 253.—Tests were made with 3 lubricants, namely, Lasin, Everclear, and Nepheless, in order to det. which was the most effective in preventing "steaming" of the glass surface. The temp. at which the untreated glass was obscured was 19°, and this was reduced to −6°, −8°, and −10°, resp., after the lubricant had been applied. Nepheless, a prepn. made by S., consisted of glycerol with 20% of Na stearate added. H. G. (*C. A.*)

84. The composition of opaque glasses. J. B. KRAK. *Glass Industry*, **2**, 81–4(1920).—An account of the development of glasses for illuminating purposes. Such glass is like snow, colorless in itself but appearing white owing to the reflection and diffusion of light from innumerable small colorless particles. A number of methods for introducing these small particles into the glass have been and are in use. Alabaster and phosphate glasses are the oldest types and more recently the opacity has been produced with aid of fluorides. A list of opacifiers includes Mg silicates such as talcum and asbestos, phosphates such as bone ash, calcined guano and Na phosphate, fluorides such as Na and Ca fluorides, lepidolite, cryolite and fluorsilicates. With fluorides are used feldspar, china clay, Al_2L_3 or $Al(OH)_3$. Occasionally oxides of Sn, Ti or Zr are used. Auxiliaries are As and Sb, NaCl and $Na_2B_4O_7$, alkali and alkaline earth sulfates. Definite knowledge of the exact cause of the opacity is lacking. Various investigators have ascribed it to devitrification, imprisoned bubbles of gas or to a solid emulsion, and to colloidal particles in suspension as in a pigment. Several old batches and recent patents are included in the article. J. B. PATCH (*C. A.*)

85. Milk or alabaster glass. ASHER BLUM. *Glass Industry*, **2**, 84–5(1921).—A summary of 17 foreign and domestic patents for illuminating glassware. J. B. PATCH (*C. A.*)

86. Development of the glass industry. ALEXANDER SILVERMAN. *Glass Industry*, **2**, 92(1921).—Review. J. B. PATCH (*C. A.*)

87. Notes on glass cutting. ANON. *Diamant*, **42**, 658(1920); *Glass Industry*, **2**, 90(1921). J. B. PATCH (*C. A.*)

88. Ultraviolet and visible transmission of various colored glasses. K. S. GIBSON, E. P. T. TYNDALL, AND H. J. MCNICHOLAS. Bur. Standards, *Tech. Papers*, No. **148**, 27 pp.(1920); *Science Abstracts*, **24A**, 179; cf. *Jour. Am. Ceram. Soc.*, **3**, 338; *C. A.*, **14**, 457.—The paper summarizes investigations on 87 samples of glass, mostly colored. Spectral transmission curves extending from about 710 $\mu\mu$ throughout the visible and ultraviolet as far as any appreciable transmission is evident, are presented. The authors also give a chart connecting thickness of material and transmission. Among the uses to which such glasses may be put are ultraviolet signalling, railway signalling, improvement of visibility (both visual and photographic), eye-protection, selective filters. Photographic, photoelec., and visual methods are described. Photographic detns. were made with the Hilger sector-photometer and a quartz spectrograph. The visual data were obtained mainly with the König-Martens spectrophotometer. In an appendix some particulars of precautions necessary in obtaining data on the ultraviolet region are given and some spectrophotographs showing the effect of various solns. are included. H. G. (*C. A.*)

89. Colored glass batches. ANON. *Glasind.*, **31**, 217–8, 225–6, 233–4, 289, 297–8, 305–6(1920).—Ninety-five batches for colored glasses of many varieties are given. Cf. *C. A.*, **15**, 154. J. B. PATCH (*C. A.*)

90. **Glass cutting.** M. Pink. *Glasind.*, **31**, 313–4, 321–2, 329–30, 337–8, 345–6, 353–4, 367–73(1920).—Detailed instructions are given for cutting sheet glass of all kinds, chiefly with the diamond. Cf. Notes on Glass Cutting, *Glass Industry*, **2**, 90(1921); *Diamant*, **42**, 658(1920). J. B. Patch (*C. A.*)

91. **Gypsum as a substitute for limestone in the glass batch.** R. *Glasind.*, **32**, 325–6(1921).—This substitution is not recommended.

J. B. Patch (*C. A.*)

92. **The smoke nuisance in glass melting.** Ludwig Springer. *Glashütte*, **51**, 355–6, 371–2, 387–8, 403–4(1921).—A summary of the subject concluded by a personal experience of the author. A glass factory with a 45-m. stack was 150 m. from a forest. Neither SO_3- nor F-containing compds. were used in the batch. The fuel was coal and briquets in which a later test indicated a content of 2.0 and 1.0% respectively of volatile S. After 6 years of operation damage to the vegetation was evident in the path of the smoke from the stack. No change had been made in the fuel. Analyses of the ash of damaged and unaffected vegetation showed SO_3 to the extent of 0.19–0.20% in the latter while the former ranged from 0.30 to 0.51%.

J. B. Patch (*C. A.*)

93. **The firing of painted glass.** F. Huth. *Diamant*, **40**, 43, 57(1918); *J. Soc. Glass Tech.*, **4**, 140(1920).—Every mixture used for glass painting consisted essentially of a coloring substance and a fluxing agent, the latter effecting the combination of the former with the surface layer of the glass during the firing process. These mixts. were divided into two classes: (1) those in which coloring oxides were mixed with the flux immediately before use, and (2) the so-called "glass-painters' fluxes," in which the oxide was already united with the fluxing medium to form a glassy body, this being pulverized and mixed with oil for application to the glass. In order to prevent the furnace gases from coming into contact with the painted glass, the object to be fired was put into a muffle, and this inside the furnace. The muffle might be iron or fireclay, iron muffles being used for colors which were to be fired at a relatively low temp. The fireclay ensured a more uniform temp. throughout the interior of the muffle, and, therefore, was always used when great heat had to be applied. When the muffle was in the furnace, which might be heated by burning fuel inside it, the temp. was slowly increased, and the easily melted flux and the surface layer of glass combined and took up the coloring oxide. When this was accomplished the temp. must be very slowly lowered or the glass would crack. In practice, test-pieces were put into the muffle with the decorated object, the furnace was run for about three days, and then the test-piece examd. If the firing was complete, the fuel was removed from the furnace, which was closed up and allowed to cool for a further three days before being opened. The firing might have to be repeated two or three times, in which case the second coloring mixt. must contain more flux than the first. The repetition of the firing was a delicate process requiring careful handling. J. B. Patch (*C. A.*)

94. **Machine-drawing of glass tubing.** J. F. Springer. *Glass Industry*,

2, 110–12, 138–40(1921); illus.—A detailed description of the Edward Danner tube-drawing machine as operated by the Kimble Glass Co. of Vineland, N. J. J. B. Patch (*C. A.*)

95. Novel method of handling molten glass. Anon. *Glass Industry*, 2, 142(1921).—Molten glass can be drained from tanks through a 1″ hole on to a 40′ steel pan conveyor on which water is sprayed. This delivers the glass to another belt conveyor similarly equipped with water on which a canvas belt impregnated with rubber has been used successfully. Saving of time and labor is effected and the glass is very conveniently broken up. J. B. Patch (*C. A.*)

96. The alkalimetric testing of glassware. F. Mylius. *Z. angew. Chem.*, 34, Aufsatzteil, 281–4(1921).—A paper on the eosin reaction. Cf. *C. A.*, 2, 450; 4, 2557; 8, 1000. J. B. Patch (*C. A.*)

97. The pot and block room. P. K. Eduard Schnurpfeil. *Glasindustrie*, 32, 169–70, 181–4(1921).—The manuf. of pots, boots, rings and tank blocks is discussed in considerable detail. Dimensions and 8 recipes are given. The casting of pots is briefly mentioned. J. B. Patch (*C. A.*)

98. Ten years of glass machinery manufacture. Anon. *Glassworker*, 40, No. 32(1921); illus.—Historical account of the machinery of Wm. J. Miller of Swissvale, Pa. J. B. Patch (*C. A.*)

99. Double refraction and crystalline structure of silica glass. Lord Rayleigh. *Proc. Roy. Soc.*, 98A, 284–96(1920); cf. *C. A.*, 14, 327, 604.—Silica glass when examd. with a special polariscope shows double refraction which is due not to stress but to a cryst. structure. This double refraction is of the order of magnitude of one-sixtieth that of cryst. quartz, and usually appears as a structure of doubly refracting grains about one-half mm. in size with no regular orientation. If the grained material is drawn out while hot, the grains elongate into fibers following the course of the material, and show "straight extinction" in the polariscope, their length being along one axis of the ellipsoid of optical elasticity. Optical silica disks show a spiral structure. By heating and cooling such a disk the structure may be made to disappear and reappear. Donald E. Sharp (*C. A.*)

100. The devitrification of glass. Harrison W. Craver. *Diamant*, 42, 379; *Glass Ind.*, 1, 40(1920).—A brief description of the process of devitrification. Donald E. Sharp (*C. A.*)

101. Use of light soda ash in the production of flint bottle glass. C. A. Cole. *Glass Ind.*, 1, 34–8(1920).—Lime batch containing light soda ash may be melted in glass tanks without a tendency toward formation of scum or seeds if high temp. and uniform methods of feeding are employed. A melting temp. of 2450°F (1340°C) is recommended. Analysis of batch and resultant glass show that little alkali is lost in melting. Donald E. Sharp (*C. A.*)

102. The occurrence of crust or scum on continuous bottle tank furnaces. Wilbur F. Brown. *Glass Ind.*, 1, 29–30(1920).—Crust or scum in the melting chamber of glass tanks is usually high in SiO_2 and Na_2O but low in CaO. The causes of its formation are, a "cool" tank, or a batch of too high SiO_2

or CaO content. It can best be removed by using a proper batch and maintaining high temps., not by adding the common fluxing materials. Analysis of two-typical scums are given. D. E. Sharp (*C. A.*)

103. New Bergman gas and air valve described. Henry W. Hess. *Glassworker*, **40**, No. 51, 11(1921); 2 illus.—"This valve is unique and practical in that the gas and air are reversed by the same operation and simultaneously, either by hand or automatically, being controlled by clock work and motor or by a thermostat placed in the checker work of the regenerators. This latter is a most essential and valuable feature, and greatly facilitates the regulation of even temps." The valve is circular in shape, brick-lined, water sealed, and is divided into 6 segments. The duration of reversal is 10 seconds during which time the valve passes through an angle of 120°.

J. B. Patch (*C. A.*)

104. The industry of silica glass. G. Flusin. *Chimie & industrie*, **5**, 119–35 (1921); cf. *Jour. Am. Ceram. Soc.*, **4**, 868(1921).—The manuf. of the opaque and semi-translucent varieties of quartz glass is discussed. By means of the heat developed by passing a heavy current through a graphite rod embedded in pure quartz sand in a furnace, a cylinder of semi-fused quartz is formed around the resistor. The temp. is raised to such a degree that the gases formed by interaction between the quartz and the graphite core sep. the tube of quartz from the core. The tube is then withdrawn from the furnace, freed from adhering sand, and formed by drawing, blowing in molds, pressing, etc., the operations being fairly easily performed once the initial resistance due to surface cooling has been overcome. The outer surfaces of the objects are sand-blasted to remove incompletely fused grains of sand. Semi-translucent ware is produced by severe sand blasting followed by treatment with HF, by forming the quartz cylinder inside a graphite cylinder so that the entire charge of sand is used and both surfaces are subjected to radiant heat, or better by reheating to the softening point. This last method results in a marked decrease in size of the bubbles which are largely responsible for the opacity. J. S. Laird (*C. A.*)

105. The industry of silica glass. George Flusin. *Chimie & industrie*, **5**, 257–70(1921); cf. preceding abstract.—The manuf. of transparent quartz is described. The raw material for this variety must be of the highest purity both to avoid the discoloration caused by foreign oxides and to prevent the evolution of bubbles from chemical action. Zirconium and silicon carbides in one of their several forms are the most satisfactory refractories to date. A number of ingenious methods for avoiding or getting rid of the air bubbles occluded in the melt are briefly mentioned and patent references given. The quantity of air entrapped in the quartz mass is greatly increased by an expansion in vol. of about 1% at a temp. of 575° caused by a change in the cryst. structure to the β quartz allotrope. Devitrification is a source of trouble and is reduced by complete freedom from bubbles and other impurities. A bibliography of 117 items is attached to the article. J. B. Patch (*C. A.*)

106. Modern development in manufacture of building glass. Robert G. Skerrett. *Compressed Air Mag.*, **26**, 10135–42(1921); *Glass Ind.*, **2**,

194–7(1921).—A descriptive article of modern processes with numerous first class illustrations. J. B. Patch (*C. A.*)

107. The steam gage tube situation. J. F. Springer. *Glass Ind.*, **2**, 183–7(1921); 3 illus.—A very complete description of the hand process of drawing glass tubing, and of the impossibility of attaining precision in the diam. and wall dimensions of drawn tubing. J. B. Patch (*C. A.*)

108. The etching of flashed glasses. Ernst Beutel. *Glas-industrie*, **30**, 109–10(1919). J. B. Patch (*C. A.*)

109. "Keramo." F. Z. *Glas-ind.*, **30**, 197–8(1919).—Descriptive of the French Garchey process for the manuf. of decorative building stones from glass. J. B. Patch (*C. A.*)

110. Is there need for improved glass in preserve jars? H. Thiene. *Glas-industrie*, **30**, 101–3(1919).—T. demonstrates the need for better glass to withstand temp. changes and soly. Jena glass is recommended. J. B. Patch (*C. A.*)

111. Development of various types of glass. C. J. Peddle. *J. Soc. Glass Tech.*, **4**, 299–366(1920).—The prepn., stability, and optical properties of the following series of alkali, PbO, silica glasses were studied: 100 SiO_2, 40 Na_2O, xPbO; 100 SiO_2, 20 Na_2O, xPbO; 100 SiO_2, 40 K_2O, xPbO; 100 SiO_2, 20 K_2O, xPbO; 100 SiO_2, 20 Na_2O, 20 K_2O, xPbO; 100 SiO_2, 10Na_2O, 10 K_2O, xPbO, where x varied from 5 to 40 mols. All the glasses can be founded above 1350° and exhibit corrosive action on pot clay, increasing with increased alkali content. Glasses of the soda series tend to devitrify if contg. more than 65% SiO_2, and those of the mixed alkali series if the silica content exceeds 61%. The potash glasses show no signs of devitrification, but all film badly on prolonged heating at 900°. In all cases density and refractive index increase with increasing content of PbO, the rate of increase falling as the PbO content rises. Dispersion also increases with increase of PbO, but ν falls as η_D rises. Comparison of the above and also of further series contg. equal percentage amts. of potash and soda showed all the soda glasses to have higher densities than the corresponding potash glasses, the mixed alkali glasses having intermediate values. In the equimol. series the potash glasses have slightly higher refractive index and total dispersion, but in the series contg. equal. wts. of alkali the soda series has higher refractive index and dispersion. The refractive index and dispersion of the mixed alkali series are intermediate between those of the soda and the potash series. The soly. of the glasses in water decreases as the content of PbO or silica rises but increases rapidly with increase of alkali. Soly. tests prove the following glasses to be of first-class durability for optical requirements: Glasses of the mol. formulas, 20 Na_2O, 30 PbO, 100 SiO_2; 20 Na_2O, 40 PbO, 100 SiO_2; 10 Na_2O, 10 K_2O, 30 PbO, 100 SiO_2; 10 Na_2O, 10 K_2O, 40 PbO, 100 SiO_2; 20 K_2O, 40 PbO, 100 SiO_2; also glasses of the percentage compns., SiO_2 50, Na_2O 10, PbO 40; SiO_2 50, K_2O 10, PbO 40; SiO_2 40, Na_2O 10, PbO 50; SiO_2 40, K_2O 10, PbO 50; SiO_2 60, Na_2O 5, K_2O 5, PbO 30; SiO_2 50, Na_2O 5, K_2O 5, PbO 40; SiO_2 40, Na_2O 5, K_2O 5, PbO 50. The first two of the mol. series approximate in optical consts. to well known Schott glasses.

The Benrath formula 6 SiO_2, 1 R_2O, 1 PbO does not give a very stable type of alkali-PbO-silica glass, a more satisfactory one being 5 SiO_2, 1 R_2O, 1.5 PbO. J. S. C. I.

PATENTS

112. **Cleansing and polishing paste for glass.** J. M. Schwaner. U. S. 1,382,019, June 21. The mixt. is formed of whiting 58 lbs., powdered pumice 16 lbs., kerosene 19 lbs., Na_2CO_3 3 lbs., NaCl 3 lbs. and essential oils such as oils of citronella and geranium 2.5 oz. each. (*C. A.*)

113. **Glass.** E. C. Sullivan and W. C. Taylor. U. S. 1,369,988, Mar. 1. A glass adapted for *manuf. of elec. lamp bulbs* is formed of SiO_2, 62–79.4, Na_2O 16–23, MgO 1.6–15, CaO 0–8.8 and ZnO 0–3.1 parts. (*C. A.*)

114. **Polish for glass or metals.** H. Swanson. U. S. 1,381,250, June 14. A mixt. adapted for polishing Ag, Au or glass is formed of H_2O 8 oz., naphtha soap 1.75 oz., pptd. $CaCO_3$ 4 oz., $NaHCO_3$ 0.15 and cream of tartar 0.24 part. (*C. A.*)

115. **Finishing glass.** L. Showers. U. S. 1,373,532, Apr. 5. Smooth relatively opaque glass is polished with a polishing powder of about the same color as the glass with polishing devices maintained at such a temp. as to cause "burning" of the glass. A "soft" finish is thus formed on Carrara or other glass. (*C. A.*)

116. **Apparatus for annealing glass or similar heat-treatments.** D. E. Gray. U. S. 1,372,420, Mar. 22. (*C. A.*)

117. **Mirrors.** C. L. Tomlinson. Brit. 163,606, June 23, 1920. A glass mirror having a metallic reflecting surface embedded beneath its surface is made by depositing on a high-CaO glass Au, Ag, Pt, or Cu, and heating the glass for a short period in such a way that the surface only is caused to melt and absorb the deposit of metal. To form the metallic coating, dry chloride of Au, Ag, Pt, or Cu is mixed with oil of rosemary and made into a paste which is thinned with oil of lavender. The paste is applied to the polished surface of the glass, which is then heated sufficiently to evap. the oils. (*C. A.*)

118. **Translucent antislipping tile.** M. F. Beecher. U. S. 1,374,136, Apr. 5. A safety tread material is formed of a translucent substance such as glass into which are fused particles of hard, wear-resisting, antislipping material such as cryst. Al_2O_3 granules. (*C. A.*)

119. **"Antislipping tile."** H. K. Dodge. U. S. 1,377,960, May 10. Tread blocks are formed of particles of cryst. Al_2O_3 or material of similar hardness constituting the major portion of the block, and a binder of vitrified ceramic material. *C. A.*

Enamels

120. **Anti-corrosive chemical engineering plant. Pumps for corrosive liquids.** Anon. Eng. Dept. Guthrie & Co. Accrington, Eng. *Canad. Chem. Met.*, **5**, 341–44(1921); *Engineering*, **110**, 253–54(1920).—Describes centrifugal pumps and other equipment lined with a new cer. acid and heat

resisting coating, called ceratherm, which resembles porcelain. The cer. lining is cast in the desired form and cemented into place with an acid proof cement. It is a good heat conductor, resists sudden temp. changes, has high tensile strength and is claimed to be superior to all other cer. coatings hitherto employed. ED.

121. Enameled steel manufacture. CHESTER H. JONES. *Chem. Met. Eng.*, **25**, 883–86(1921).—The enamel is prepd. and applied by both the wet and the dry process. There are in general 4 different coatings used depending upon the service to which the ware is to be subjected. One is supplied for the malt industry only; the dairy, soft drink and pharmaceutical trade use another type; the third enamel is designed to resist all and any degree of acidity, and finally a special coat is used which is more decorative and while not compounded to combat acid has a reasonable resist. to it. Raw mats. ordinarily used are ground sand, quartz, feldspar, borax, cryolite, fluorspar, sodium and potassium compounds and clay. The raw mats. for making the frit are mixed by hand or in revolving drums. Five Abbé pebble mills and 4 special rotary smelters comprize the glaze room app. Ordinarily wet enamels are sprayed on the heavy pieces through the medium of a portable air spray nozzle guided by the hand of the operator. Chem. plant ware may be treated by the dry process, or dusting. In this case the metal surface is wetted and the dry powdered frit dusted on where it adheres to the water film. The equipment for burning enamel to the steel consists of a total of 7 furnaces, 4 of which are the open type, 2 complete muffle type and 1 vertical furnace of special design used for firing small articles that would involve waste of heat if treated in the large furnaces. This furnace consumes oil for fuel, the remainder burning coke. Muffle furnaces are employed largely for burning light wares, especially the light enamels, while the heavier steel pieces are fired in the open type. The temps. range from 1,500° to 2,000°F. The temp. in any one firing depends on the enamel. Hoskins' pyrometers record the temps. of each furnace. Adjacent to each battery of furnaces is one enamel application room. The coated ring or tank is picked up by a traveling charging crane and placed in the open-type furnaces, where it is revolved on a turntable while burning. The muffle furnaces are served by power tongs, which pick the pieces from tables moving on industrial tracks along the front of the battery and place them within the burning chamber in each case. The special upright circular kiln is charged through split doors in the top and is equipped with two firing holes located in the side near the bottom. The waste gases from all furnaces is conducted through waste heat boilers in the power plant. H. F. S.

122. Enamel-lined apparatus. CHESTER H. JONES. *Chem. Met. Eng.*, **25**, 927–932(1921). General description of the plant of the Elyria Enameled Products Co., Elyria, O. (See preceding abstract).—The company makes 3 general grades of enamel (compns. not given) some of the uses of which are outlined in the following paragraphs. Enamel No. 11, which is applied to cast-iron ware, has been found to resist the action of inorganic acids such as

hydrochloric, nitric, phosphoric, sulphuric, hydrobromic, hydriodic, aqua regia at any strengths and any mixts. of these. It is acted upon by hydrofluoric acid of any strength. It resists action of stannic chloride in hydrochloric acid, zinc chloride up to 300°C, gaseous hydrochloric acid, aluminum chloride, bromine, chlorine, iodine (moist or dry), tungstic oxide precipitation by hydrochloric and nitric, sulphur dioxide, thorium nitrate in nitric acid, and manganese dioxide with hydrochloric acid. It may be used for all org. acids, acid chlorides and org. compds., being particularly resistant to acetic vapors. It is successful in vessels for heating magnesium hydroxide under pressure, for evapg. lime salts of sulphocarbolates or boiling sodium carbonate, for ammonia and sodium or potassium salts of inorg. comps., but is decomposed by caustic alkalies and is acted upon slightly by hot milk of lime. Sodium cyanide and similar salts are too alkaline and react with it. It is more resistant to alkalis than most enamels. Enamel No. 20, which is applied to steel, has been used successfully for all strengths of org. acids (hot or cold), ammonium sulphate, acetic anhydride, acetic acids of all strengths (but not vapors), brine, moist chlorine, hydrochloric acid in alcohol, hydriodic acid, lactic acid of all strengths (hot or cold), hot phenol, tin chloride plus 1% hydrochloric acid, zinc chloride soln., hot sulphur chloride, inorg. acids below 0.5% strength cold, sulphuric acid above 50% strength and mixed acids high in sulphuric acid, hot or cold. If the reagent is one which attacks iron severely, the enamel coat must be perfect, limiting the size to 600 gal. If there is no severe action on iron, any size up to 3,000 gal. can be had. The limiting size must be decided for each condition by itself. It is also used for hot carbonate, cold sodium hydroxide 10% and hot ammonia. Enamel No. 21, which is also applied to steel, is used for all conditions of milk, such as milk heating, holding, mixing, etc.; for oils, fats, alcoholic solutions of shellac, ammonia, aniline hydrochloride, acetic acid, storage cold; ammonium nitrate, bleach liquor, dry chlorine, dry hydrochloric acid gas, cold beverage sirups involving citric acid, grape juice, hydrogen peroxide, tincture of iodine, making invert sugar, hot oil of peppermint, cold phenol, salicylic acid and hot acetic anhydride, dry sulphur dioxide, tannic acid, hot bromine, distilled water, and hot fuming sulphuric. The last has been handled more successfully by No. 21 than by other enamels. For perfect coats the sizes are limited to 1,000 gal. Otherwise any size up to 7,000 gal. can be obtained. Here, as with No. 20, the limiting size can be detd. only after making a study of the case in hand. Cast iron units may be used with 75-lb. steam pressure in the jacket and up to 100 lb. inside the still. It has a coeff. of heat transmission about $^1/_4$ that of copper. With steam, temp. up to 160°C in the jacket can be obtained. Up to 225°C an oil jacket can be used. Superheated steam at 315°C has been used on the small units. The enameled units have also been heated by a direct, well-spread flame up to temperatures of 300°C, but such service is rather severe, limiting the life of the enamel. Steel units are usually heated by means of a steam jacket, the 500-gal. sizes permitting 30-lb. pressure, the large ones, such as 3,000 gal., being limited to 10-lb. pressure. The pressure within the tank may be $1^1/_2$ times as great as that in

the jacket. The coeff. of heat transmission is about $^1/_3$ that of copper, using straw as a heating medium. Using oil in the jacket (which has been done up to 250°C), the coeff. drops to $^1/_5$ that of copper. H. F. S.

123. Enameled Products Research Laboratory. EMERSON P. POSTE. *Chem. Met. Eng.*, **25**, 974(1921).—A detailed description of the research laboratory of the Elyria Enameled Products Co., Elyria, O. Facilities are provided for small-scale factory opern. expts. in cer. engineering, with special reference to enameling of metals, chem. engineering, and metallurgical engineering. An analytical dept. serves the 3 other depts. H. F. S.

124. The new Meurer enamel spraying process. ANON. *Glashütte*, **51**, 131–2, 147–8(1921); cf. *Jour. Am. Ceram. Soc.*, **4**, 787; *ibid.*, **4**, 1015; 1 fig.—A modification of the Schoop spraying gun or nozzle. J. B. PATCH (*C. A.*)

Heavy Clay Products

125. New method for drying clay. ANON. *Chem Met. Eng.*, **25**, 753 (1921).—Pottery plants at Devon and Cornwall, are now using a new method for drying clays, in which two metal drums are employed, one enclosed in the other. The inner drum is driven by mech. means, and while revolving, steam enters in at a few degrees above the temp. of boiling water. The clay is passed into the outer drum and comes into contact with the inner drum as it revolves, filled with steam. The water in the clay is evapd. and the clay dries quickly, the process being one measured in mins. H. F. S.

126. Some causes of the so-called disintegration of terra cotta brick, and allied ceramic materials and suggested remedies. H. A. PLUSCH. *N. J. Ceramist*, **1**, 65(1921).—Discussed under the following headings (1) high porosity of the body; (2) high silica content of the body; (3) the effect of soluble salts; (4) poor workmanship; (5) lack of mortar in joints and poor mortar; (6) uneven thickness of ware; (7) effect of the sun and frost; (8) settlement of buildings. C. W. PARMELEE

127. A note on body cracking of terra cotta. E. C. HILL. *New Jersey Ceramist*, **1**, 70(1921).—The author concludes that fire cracking may not be due to variations in the firing temp.; that it seems possible to crack a body of almost any compn. by too rapid cooling; that a considerable range of compn. is possible in bodies without producing fire cracking, if the pieces are cooled slowly; dense bodies are more sensitive, therefore the use of grog of suitable size and quantity is advisable; the greater the amount of sandy clays used the greater the contraction between 650° and 850°; the most effective prevention is slow cooling at the lower temps. particularly from 650° to 500°C. C. W. PARMELEE

128. Building blocks made from boiler scale. KOCH. *Tonind. Ztg.*, **44**, 360; **47**, 387, 388(1921).—A factory has been started at Eberfeld to manuf. cheap building blocks for workmen's dwellings from a slime obtained by digesting the slag produced by the municipal gas plant. They claim to have a capacity of $2^1/_2$ million blocks per annum, and to produce building blocks at low fuel cost. WM. M. CLARK

129. Report of Committee C-3 on brick. H. T. SHELLEY AND WARREN E. EMLEY. *Proc. A. S. T. M.*, **21**, 284(1921).—*Cement brick* has been included in the committee's activities. The committee recommendations on specifications for sewer brick follow. ED.

130. Tentative specifications for clay sewer brick. ANON. *Proc. A. S. T. M.*, **21**, 527–32(1921).—These specifications cover four classes of clay bricks intended to be used in drainage structures for the conveyance of sewage, industrial waste and storm water, as follows, the purposes for which they are intended to be especially suitable being indicated:

Class A Vitrified Brick, for the interior of structures where resist. to the abrasive action of velocities up to 18 ft. per sec. is required.

Class B Vitrified Brick, for the interior of structures where resist. to the abrasive action of velocities up to 12 ft. per sec. is required.

Hard Brick, for structures requiring imperviousness to internal and external pressures and resist. to the abrasive action of velocities up to 8 ft. per sec.

Medium Brick, for storm water conduits, where a high degree of imperviousness is not required and where abrasive action is due to low velocities only.

For definitions of the above classes, see Table I.

TABLE I.—PHYSICAL TEST REQUIREMENTS FOR DIFFERENT CLASSES OF BRICK

	ABSORPTION LIMITS, PER CENT		COMPRESSIVE STR. (ON EDGE), LB. PER SQ. IN.		MODULUS OF RUPTURE, LB. PER SQ. IN.	
Glass	Mean of 5 tests	Individual maximum	Mean of 5 tests	Individual minimum	Mean of 5 tests	Individual minimum
Class A Vitrified	3 or less		5000 or over		1200 or over	
Class B Vitrified	5 or less	6.0	5000 or over	4000	1200 or over	800
Hard	5 to 10	12.0	3500 or over	2500	600 or over	400
Medium	10 to 15	17.0	2000 or over	1500	450 or over	300

Bases for purchase and acceptance are established. Nature of *raw materials*, *standard sizes*, and *methods of sampling* are specified. Provision is made for the following tests, details of which are described: *Chem. examn.; absorption, compressions* and *transverse tests; visual inspection.* ED.

131. Report of Committe C-4 on clay and sewer pipe. R. HERING, G. T. HAMMOND AND A. J. PROVOST, JR. *Proc. A. S. T. M.*, **21**, 285(1921).—No revisions were made in specifications. Sub-committees are now considering the following subjects: Absorption and hydrostatic pressure test requirements; chem. requirements; dimensions and their permissible variations; methods of testing; nomenclature and definitions. E. N. BUNTING

132. Report of Committee C-6 on drain tile. ANSON MARSTON AND J. T. STEWART. *Proc. A. S. T. M.*, **21**, 286–88(1921).—The tentative specif. for drain tile on p. 817 of the 1920 Proceedings have been recommended for adop-

tion as standard. The vital importance of thorough underdrainage in connection with all types of roads is just beginning to be realized and the hundreds of thousands of miles of tile required will be subjected to the standard tests. The main research investigation being carried on at present is the best development of chem. tests and chem. test requirements for drain tile to det. their resist. to the action of soil acids and alkalies. This research is being carried on at 5 different laboratories and will require at least 2 years to develop standard specifications. E. N. BUNTING

133. Report of Committee C-10 on hollow building tile. WALTER A. HULL AND CHAS. C. CROCKATT. *Proc. A. S. T. M.*, **21**, 324–25(1921).—As it has been found that the absorption test does not satisfactorily differentiate between acceptable and unacceptable tiles, the test has been omitted from the latest tentative specif. It is also recommended that the test specimens be taken from unbroken tile, as it has been found that while unbroken specimens may resist freezing satisfactorily, fragments from similar pieces do not. The Hollow Building Tile Association, in coöperation with the Bureau of Standards is carrying out an investigation of the physical properties of hollow building tile with special reference to their fire resist. and data already obtained has proved of great assistance to the Committee in the prepn. of the tentative specifications. E. N. BUNTING

134. Tentative specifications for clay hollow building tile. ANON. *Proc. A. S. T. M.*, **21**, 547–52(1921).—The specif. cover (1) Materials and manuf. (2) Physical props. and tests, including (*a*) compression test, freezing test, fire test; (*b*) selection of samples for test; (*c*) strength tests; (*d*) freezing test; (*e*) tolerances. (3) Standard sizes and dimensions. (4) Workmanship and finish. (5) Marking. (6) Inspection and rejection. E. N. BUNTING

135. Tentative definitions of terms relating to hollow tile. ANON. *Proc. A. S. T. M.*, **21**, 602–603(1921).—The definitions cover the following: I. Kinds of tile, as (1) hollow clay, (2) terra cotta, (3) hollow-building, (4) load-bearing: (*a*) floor, (*b*) foundation, (*c*) side construction, (*d*) end construction, (*f*) book, (*g*) vitrified, (*h*) salt-glazed; (5) hollow fire proofing, as (*a*) partition, (*b*) furring, (*c*) porous. II. Raw materials: (6) shale, (7) fire clay, (8) surface clay. III. Designation of dimensions, as (9) thickness, (10) width, (11) length. IV. Parts, openings, and surface features: (12) shells, (13) webs, (14) cells, (15) scoring. E. N. BUNTING

PATENT

136. Bricks. R. MILNER and T. ROBINSON. Brit. 163,569, April 13, 1920. Blast-furnace slag is ground and mixed with not more than 20% of clay and a sufficient quantity of ground C fuel to form a self-burning mixt., which is molded into the required shapes for bricks, etc., dried and then fired in kilns. A suitable mixt. is 70–85% slag, 5–20% clay, and 5–15% fuel.

Cement, Lime and Plaster

137. Bentonite. R. B. LADOO. Bureau of Mines Report. No. 2289, 5 pp. October, 1921. *Jour. Ind. Eng. Chem.*, **14**, 89(1922).—This rept. devotes

particular attention to the commercial utilization of bentonite in the manuf. of paper, soap, *gypsum* and *lime plasters*, adhesive paste, and as a water softener and dewatering agent for crude petroleum. ED.

138. **"Mazout" (burning oil) as fuel for lime kilns.** A. STOLL. *Rev. Mat. Constr. Trav. Pub.*, **146**, 216–17(1921).—Sketches of kiln and burner to take place of those given with article on the same subject in **142**, 129–30 (1921). Cf. *Jour. Amer. Ceram. Soc.*, **4**, 873.

139. **Artificial cement by the "two fire" practice.** C. DIDIER. *Rev. Mat. Constr. Trav. Pub.*, **146**, 201–203(1921).—Limestone is first burned, then slaked, giving an impalpable powder. The powder can be screened, then mixed with the requisite amts. of clay and water, pressed into brick, and then burned either in a vertical or a rotary kiln. D. favors the vertical kiln for the reason that higher temps. can be more readily and less expensively obtained than in the rotary kiln. LOUIS NAVIAS

140. **Acid proof cements.** DR. KLEINLOGEL. *Tonind. Ztg.*, **55**, 460(1921).—Described expts. with cements resisting the attack of acids and water. WM. M. CLARK

141. **The English cement standards.** ANON. *Tonind. Ztg.*, **51**, 423, 424(1921).—The specifications surrounding the pull test and Vicat needle indentation test on specimens of cement are described. WM. M. CLARK

142. **Superior cements.** H. KÜHL. *Tonind. Ztg.*, **49**, 406, 407(1921).—Consideration of improved quality and limitations governing the factors entering into same. WM. M. CLARK

143. **Testing of plastic calcined magnesite for use in oxychloride cements.** MAX Y. SEATON. *Proc. A. S. T. M.*, **21**, 1039–49(1921).—A short discussion of the general properties of oxychloride cements is followed by the physical tests for such cements including strength tests, setting time, vol. change, and permanence. The factors influencing the properties of these cements are given, *viz.*, the consistency of the mortar, the strength of the $MgCl_2$ soln., the character of the aggregate, storage conditions, and the quality of the calcined magnesite used. There is a wide discrepancy between the chem. anal. and physical tests, due to the fact that the time-temp. history of the calcining procedure is of vital influence on the reaction between MgO and $MgCl_2$. Suggested specif. are given. E. N. BUNTING

144. **Report of Committee C-9 on concrete aggregates.** S. E. THOMPSON AND A. T. GOLDBECK. *Proc. A. S. T. M.*, **21**, 317–21(1921).—Several tentative standards have been presented for adoption. Grading and impurities have become more and more prime factors in dealing with materials for concrete. An outline of various tests and researches is given, the lines of research in which the committee are engaged being (1) Laws of mech. mixts. of cement and aggregate; (2) Further researches on impurities; (3) Investigations of coarse aggregates to det. their relative value for concrete and mixts.; (4) The best type of specimen for mortar test; (5) The distribution of aggregate materials throughout the country; (6) Specif. for concrete; (7) Testing of field concrete after it is in place. E. N. BUNTING

145. Tentative specifications for concrete aggregates. ANON. *Proc. A. S. T. M.*, **21**, 544–46(1921).—Under fine aggregate are the definition; grading; strength in concrete; mortar strength; colorimeter test; concrete tests. Under coarse aggregate are the definition and the grading.
E. N. BUNTING

146. Report of Committee C-7 on lime. H. C. BERRY AND L. H. HART. *Proc. A. S. T. M.*, **21**, 289–93(1921).—A large amt. of research work has been done by the members of the committee on the prepn. of specif. for lime. It is requested that the present standard specif. for quicklime and hydrated lime be withdrawn and the revised specif. be adopted as tentative. A series of panel tests of lime plaster is under way and extensive research into the quality of sand suitable for use with lime as a plaster is being conducted. Revised methods of anal. have been recommended for tentative acceptance. Methods of detg. "available lime" and the d. of bulk lime have been developed and will be submitted at a later date. The plasticimeter designed by the Bureau of Standards has been adopted as a plasticity measuring instrument. It has been detd. that the plasticity of finishing hydrate is dependent upon its colloidal content. A very important advance has been made in the development of a set of directions for slaking lime and for the prepn. of mortar from putty. E. N. BUNTING

147. Coöperative tests on the effect of hydrated lime on concrete mixtures. ANON *Proc. A. S. T. M.*, **21**, 294–301(1921).—Test results from 5 laboratories, principally on wear and compression are given on the effect of small additions of hydrated lime to concrete mixts. used in roadwork. From the large no. of tests made it appears that the addition up to 15% of lime has little effect upon the compression strengths, but variable values are obtained, dependent upon the sand and the different kinds of fine aggregate used, ranging from 90% to 110% of the strength without the addition of lime. Addition of lime increases the wear from 5 to 50%. In the discussion Mr. D. A. Abrams gives a large number of tests which confirm in general the above results. E. N. BUNTING

148. Tentative specifications for quicklime for standard purposes. ANON. *Proc. A. S. T. M.*, **21**, 533–36(1921).—The specif. cover the following: definition; general quality; classes and sizes; basis of purchase; sampling; chem. properties and tests; physical properties and tests; inspection and rejection; method of test for percentage of waste. An appendix gives directions for slaking and for prepn. of putty for use. E. N. BUNTING

149. Tentative specifications for hydrated lime for structural purposes. ANON. *Proc. A. S. T. M.*, **21**, 537–43(1921).—After giving the defn. for hydrated lime, specif. for mason's hydrate are given under uses; chem. properties and tests; physical properties and tests, such as fineness, constancy of vol. and tensile strength; packing and marking; inspection and rejection; methods of test for fineness, constancy of vol. and tensile strength. Under finishing hydrate are uses; properties and tests; marking; general require-

ments; plasticity, which is detd. with the Emley plasticimeter, a diagram of which is given. E. N. BUNTING

150. Tentative methods of chemical analysis of limestone, lime and hydrated lime. ANON. *Proc. A. S. T. M.*, **21**, 565–76(1921).—After giving directions for the treatment of the sample, methods are given for the detn. of SiO_2, Fe_2O_3, Al_2O_3, CaO, SrO_2, MgO, ignition loss, mech. moisture, CO_2, SO_3, total S, P, MnO, and FeO. Over a page of notes are included. E. N. BUNTING

151. Report of Committee C-11 on gypsum. WARREN E. EMLEY AND V. G. MARANI. *Proc. A. S. T. M.*, **21**, 326–28(1921).—Revisions made in the tentative specif. are listed. (Specif. are abstracted below.) E. N. BUNTING

152. Tentative specifications for gypsum. ANON. *Proc. A. S. T. M.* **21**, 553–55(1921).—The specif. cover (1) materials and standards, (2) sampling, (3) packing and marking, (4) inspection and rejection. E. N. BUNTING

153. Tentative specifications for calcined gypsum. ANON. *Proc. A. S. T. M.*, **21**, 556–58(1921).—The specif. include the same items as Abs. 152. E. N. BUNTING

154. Tentative specifications for gypsum plastering sand. ANON. *Proc. A. S. T. M.*, **21**, 559(1921).—The sand should be free from salt and from alkaline, organic and other deleterious substances and should be of the proper fineness. E. N. BUNTING

155. Tentative methods of testing gypsum and gypsum products. ANON. *Proc. A. S. T. M.*, **21**, 590–99(1921).—The methods cover, (1) detn. of free water in gypsum, (2) detn. of fineness, (3) chem. anal. of gypsum for combined H_2O, CO_2, SiO_2, and insol. material, Fe_2O_3 and Al_2O_3, CaO, MgO, SO_3 and NaCl. Notes on methods, (4) precautions for physical tests, (5) testing consistency of calcined gypsum, using a Southard viscosimeter, diagram of which is given, (6) water-carrying capacity, (7) detn. of dry bulk and (8) of wet bulk, (9) detn. of time of setting, (10) of tensile strength, (11) of compressive strength, and (12) of sand-carrying capacity of calcined gypsum. E. N. BUNTING

156. Tentative definitions of terms relating to the gypsum industry. ANON. *Proc. A. S. T. M.*, **21**, 600–601(1921).—The following terms are defined: acceleration, aggregate, binder, cement, consistency, Keene's cement, mortar, plaster, plasticity, retarder, stucco, wood fiber. E. N. BUNTING

157. The effect of some physical conditions on calcium sulfate cements. C. L. HADDON. *J. Soc. Chem. Ind.*, **40**, 122–3T(1921).—Brief description is given of setting of anhydrous $CaSO_4$ cement and discussion of expansion and contraction in setting. Measurements of expansion were made by Le-Chatelier's app. on a number of samples. Results of expts. show (1) the expansion was least when accelerating solns. were used, and greatest when retarders were used; (2) wet set plaster using 5% soln. of sulfate as accelerator, although reaching its max. strength within 24 hrs., yet continued to expand during crystn., (3) wetness has great effect on tensile strength and the degree of wetness affects expansion, (4) the expansion under normal conditions is

very small—about 0.1%—and ceases within 7 days. The effect of expansion on the tensile strength and the weakness of flooring plaster by wetness and also the effect of mineral oils are discussed briefly. It is suggested that the conditions for briquette breaking should be precisely as is done with Port. cement—leave the briquettes in the mold for 24 hrs., take them out and place them in H_2O and then break the wet briquettes after a week. C. N. Wiley (*C. A.*)

158. Crystallization processes and transformations in the hardening of Portland cement. F. Schott. *Tonind. Ztg.*, **62**, 537(1921).—Description of chem. and crystn. changes observed. Wm. M. Clark

159. The dependence of the lime industry upon nature and science. A. D. Little. *Chem. Met. Eng.*, **25**, 149–52(1921).—An address. The markets for lime developed as a result of scientific investigation. The technical problems of the industry are discussed. Phys. properties are often more important than chem. properties. Progress already attained in kiln design and the mechanical equipment for the transportation of materials must be followed by accurate chem. control of operations. W. H. Boynton (*C. A.*)

160. Gypsum. Frank A. Wilder. *Mineral Ind.*, **29**, 340–8(1920).—1920 was a record year in all branches of the gypsum industry. Agricultural gypsum increased 270%. A. Butts (*C. A.*)

161. Lime in 1919. G. F. Loughlin and A. T. Coons. U. S. Geol. Survey, *Mineral Resources of U. S., 1919*, Part II, 405–18(preprint No. 31, published Oct. 6, 1921). E. H. (*C. A.*)

162. Cement. Robert W. Lesley. *Mineral Ind.*, **29**, 74–87(1920).—A review of the cement industry in the U. S. and foreign countries, giving statistics and notes on technology. A. Butts (*C. A.*)

163. Cement in 1919. Ernest F. Burchard. U. S. Geol. Survey, *Mineral Resources of U. S., 1919*, Part II, 387–404(preprint No. 30, published Sept. 21, 1921). E. H. (*C. A.*)

164. Interpreting the chemical analysis of Portland cement. J. W. Witt. *Eng. News-Record*, **87**, 650–2(1921).—The limitations of chem. analysis in testing Portland cement are discussed. The relative amts. of the several components can not be detd. directly, and indirect analysis involves so many sources of errors that the results are not dependable. Since the relation between the compn. and physical behavior of cement is not fully understood, physical tests are indispensable. J. C. W. (*C. A.*)

165. The destruction of cement and of concrete conduits and masonry for sewage canals, reservoirs and similar works, and suitable means of prevention. A. Splittgerber. Mannheim. *Z. Wasserversorgung Abwasserkunde*, **7**, 46–8, 51–5, 63–5(1920).—Both cements and concretes are easily destroyed by various agents. These agents are classed according as they occur in (1) the ground underlying the works; (2) the liquid conducted or held; (3) the surrounding air and (4) the materials used as ingredients in the cement or concrete. In (1) and (2) are acids and acid salts, chiefly those giving an acid reaction with Congo red, methyl orange or rosolic acid, but occasionally those neutral to these indicators; any S compd., especially H_2S, sulfates,

sulfites, thiosulfates and sulfides; nitrates; H_2O contg. CO_2; Mg compds.; Na and K salts and saponifiable fats and oils. In (3) are chiefly H_2S and CO_2. In (4) are most frequently $CaSO_4$ and Mg compds. Together with these agents are incidental effects such as elec. energy and mechanical vibration. According to Endell the most injurious effects are from H_2O contg. sulfates of all kinds and humus waters from marshy soil. Upon the class and character of the injurious agent depend the possibility and method of protection. Cements and concretes resistant to the agents are classed as those (1) mixed without a flux; (2) with a preventive chem. compd. incorporated in the mixt.; (3) with an insol. org. compd. incorporated in the cement or concrete to prevent porosity and (4) with a superficial impregnation of a resistant substance to prevent microporosity. To (1) belong cements and concretes without a flux which reacts with the external injurious compd. Trass and puzzuolana are the commonest substances added to increase resistance in (2). (3) includes certain soaps, fats and oils incorporated in the mixt. (4) includes Mg, Si and Al fluorides, tars and asphalts. Compds. which are seldom concerned but which attack cements are $(NH_4)_2C_2O_4$, $C_3H_5(OH)_3$, sugar, NH_3 and Pb and Zn compds. Besides the agents mentioned, the mollusks, *Teredo navalis*, *Lithodomus* (*Lithophagus*) and *Pholas dactylus* destroy cements. The articles are replete with references to previous investigators but without the sources. S. asserts however that complete references in the literature will be furnished on application. C. C. Davis (*C. A.*)

PATENTS

166. Cements. E. Wallin. Brit. 157,971, Jan. 10, 1921. A cement, particularly applicable for jointless floor coverings, comprizes MgO and Mg nitrate or salts, such as $Ca(NO_3)_2$ and $MgSO_4$, which will interact to produce Mg nitrate. The materials may be mixed in the dry state and moistened when required for use. (*C. A.*)

167. Cement. H. D. Baylor. Brit. 158,390, Nov. 8, 1919. See U. S. 1,323,952. (*C. A.*)

168. Burning lime. J. C. Schaffer. U. S. 1,377,367, May 10. A steam supply is provided by which steam may be introduced beneath the grate of the furnace which heats a lime-burning kiln, in order to humidify the heating action of the furnace and temper the combustion zone extending from the furnace into the kiln.

169. Producing lime. W. Crow and J. C. Schaffer. U. S. 1,377,401, May 10. Limestone is mixed with hydrated lime and the mixt. is gradually heated for effecting porous nodulization. The product thus formed is suitable for making mortar or wall coatings.

170. Coating cement with celluloid. F. C. Ruppel. U. S. 1,379,837, May 31. A sheet of celluloid is attached to the surface of concrete tiles or other concrete bodies by an intermediate layer of fibrous fabric, *e. g.*, cheese cloth.

171. Oxychloride cement. G. M. Formby. U. S. 1,379,680, May 31. A mixt.of $Ca(OH)_2$ and $Mg(OH)_2$ is treated with HCl and the product thus

obtained is added to Portland or other cements in order to harden and strengthen them.

172. Waterproofing cement. L. M. Kregelius. U. S. 1,382,986, June 28. A waterproofing mixt. for use with cement is formed of slaked lime mixed with paraffin or similar H_2O-repellant wax-like material.

173. Fireproof and insulating cement mixture. E. R. Stowell. U. S. 1,382,329, June 21. A fireproof and insulating material adapted for use in building construction is formed of cement, Na silicate, powdered pumice and wood particles.

174. Hydrating lime. H. W. Charlton. U. S. 1,381,106, June 14. A hydrate of lime contg. less than the usual amt. of H_2O of hydration is prepd. by digesting slaked lime with an excess of H_2O under a pressure of 225 to 270 lbs. per sq. in. and at a corresponding temp.

175. Potassium compounds from cement-kiln gases. H. V. Welch. U. S. 1,382,037, June 21. Cement-kiln gases or the like are treated with H_2O in such a manner as to obtain a satd. soln., and the sludge thus obtained is then heated to render additional K compds. sol. and the soln. is sepd. from the residue for recovery or utilization of its values.

BOOK REVIEWS

American society for testing materials. Proceedings of the Twenty-Fourth Annual Meeting. Pp. 1197 + 285 figures + 6 plates. Published by the Society., 1315 Spruce St., Phila., Pa. Price: $10, paper.

Volume 21 of the Proceedings surpasses its predecessors in magnitude. The subject matter is classified under the headings (1) Committee Reports, (2) New and Revised Tentative Standards and (3) Technical Papers. Material of ceramic interest is found under each heading. Full abstracts of all such material will be found in the preceding pages of this number of *Ceramic Abstracts*. Ed.

The manufacture of optical glass and of optical systems. Ordnance Department Document No. 2307. Lieut.-Col. F. E. Wright. Pp. v + 309 and 94 figs. Government Printing Office, Washington, D. C., 1921.

According to the author, Lieut.-Col. F. E. Wright, Ordnance Reserve Corps, "The present report seeks to outline, in a general way, some of the factors which we encountered in the manufacture of optical glass and of lenses and prisms for fire control and observation instruments for the Army and Navy. The lessons to be learned from our recent experiences along these lines are so obvious that comment is unnecessary. Such lessons are soon forgotten by the country at large. It is, however, essential, that a written record be made of the war-time development of certain of the manufacturing problems as they confronted us and were solved. The record may serve a useful purpose, and be of value in case of a future emergency."

It is indeed gratifying that the record of a notable accomplishment, even though it has been well covered in journal articles, has been incorporated into

a single treatise and has been used in a permanent form. It is not only a treatise on the technology of the manufacture of optical glass and of optical systems but it is also a very readable story of the development in this country of the optical glass industry which was necessary to meet the war-time needs of the military forces and which, in a period of one and one-half years produced over 600,000 pounds of usable optical glass.

In presenting the several subjects, graphs, drawings and photographs are freely employed and particularly in the discussions of technology, numerous references are made to the literature. Accordingly this report will find a large use as a reference work and it is of particular interest to the entire glass industry by reason of the principles set forth under the discussion of the annealing of glass. The chapter titles are as follows:

I. Introduction.
II. The characteristics of optical glass.
III. The manufacture of optical glass.
IV. The inspection of optical glass.
V. The manufacture of lenses and prisms.
VI. The inspection of finished optical parts and systems.
VII. The optical instrument situation during the war.

This volume is bound in full canvas, lettered in gold and trimmed in red and black. The proof reading has been well done, the topography is excellent and a comprehensive index is included. E. W. T.

Vol. 1 APRIL, 1922 No. 4

Ceramic Abstracts

Ross C. Purdy, Editor
Lord Hall, O. S. U., Columbus, Ohio

Abstractors: E. N. Bunting, W. M. Clark, L. H. Cole, G. S. Fulcher, S. L. Galpin, Seiji Kondo, A. T. Malm, R. J. Montgomery, Louis Navias, C. W. Parmelee, C. M. Saeger, Jr., H. G. Schurecht, R. B. Sosman, H. F. Staley, E. W. Tillotson.

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General and Miscellaneous

1. Some general remarks for factory organization. ANON. *Sprech.*, **53**, 493(1920).

2. Air cracks in grog products. FISCHER. *Tonind. Ztg.*, **44**, 1270(1920).—These cracks are due to air trapped in the body.

3. An oil purifier. ANON. *Tonind. Ztg.*, **44**, 662(1920).—The impurities including water are removed from oil by centrifugal force

4. "Osmo" clay (Westerwald). ANON. *Tonind. Ztg.*, **44**, 630(1920).—The compn. of the clay and the method of purifying it are described. It is remarkable in having a high alkali and low feldspar content.

5. The condition and prospects of the British ceramic industry. J. A. AUDLEY. *J. Soc. Chem. Ind.*, **40**, 21–22(1921). E. H. (*C. A.*)

6. The Cottrell process of electrical precipitation. H. A. WINNE. *Gen. Elec. Rev.*, **24**, 910–21(1921); 13 illus.—History, theory and full detailed account of most modern app. and its operation. C. G. F. (*C. A.*)

7. Problems in heat economy (in Germany). RUMMEL. *Z. Ver. Zuckerind.*, **71**, 539–49(1921).—The principal present-day problems are: (1) The use of powdered coal (profitable only where a good grade with low ash can be obtained cheaply, and where special large furnaces are available); (2) the use of powdered semi-coke; (3) the use of coal gas; and (4) the use of steam storage tanks; these are now made with a capacity of up to 345 m.^{3} of water, into which the steam is blown at high pressure and released again as needed. By the use of these tanks a saving of 15% of coal has been effected.

F. W. ZERBAN (*C. A.*)

8. Liquid, colloidal and powdered fuels. ORMANDY. *Colliery Guardian*, **122**, 311–2(1921).—The use of oils too heavy or too impure for engine consumption is recommended for general industrial use. Difficulties of burning have been nearly overcome in Great Britain and the relative values of the fuels remain a financial problem only. C. C DAVIS (*C. A.*)

9. The use of pulverized coal. PAUL FRION. *Monit. papeterie française*, **52**, 327–8, 364–8, 409–11, 510–1, 578–9, 618–20, 681–4(1921).—A detailed analysis of the advantages and disadvantages of pulverized coal at the present time. A. P.-C. (*C. A.*)

10. Engineers for firing technique in the ceramic industry. R. CLAUSE. *Tonind. Ztg.*, **44**, 787(1920).—The writer emphasizes the importance of the field of heat engineering.

PATENTS

11. Mining and purifying clay. J. S. HIGHFIELD. U. S. 1,366,456, Jan. 25. A stream of H_2O is forced against a clay face, the resulting liquor is led to a collecting vessel and the liquor in the stream is returned against the clay face until a sufficient concn. is attained. The liquor is then passed to a settling plant, where a small amt. of an electrolyte such as Na_2CO_3 or Na silicate is added and after the liquor has been allowed to settle it is pumped to a treating plant for extg. clay from it by electrolytic treatment. (*C. A.*)

12. Bearing of vitrified shale. H. R. STRAIGHT. U. S. 1,360,244, Nov. 23.

Machine bearings are formed of natural shale by cutting it to the desired shape of the bearing, gradually heating it to the point of vitrification and then cooling. Bearings thus formed are stated to be suitable for use with steel shafts in adding machines or clocks. (*C. A.*)

13. "Artificial slate." E. Fahrig. U. S. 1,362,563, Dec. 14. A mixt. adapted for making roofing tiles or tool handles is formed of powdered slate 41, SiO_2 11, S 15, "magnesite" (MgO?) 10, talc 9, kaolin 8, and sericite 6 parts, mixed with $AlCl_3$ or $MgCl_2$ soln. (*C. A.*)

Apparatus and Instruments

14. **Measuring the gloss of paper; apparatus.** L. R. Ingersoll. *Optical Soc. of Amer.*, **5**, 213–17(1921).—The instrument measures the propn. of light which is polarized by reflection from the surface, as this is the portion regularly reflected. The scale of deg. of gloss is an arbitrary one, being the reading in degs. of the position of an analyzing nicol. Although the instrument gives the optical, as distinct from the mech. gloss it is found that the two are closely connected. Applications to *enamel* and *whiteware* surfaces are not discussed. (*Sci. Abs.*)

15. **Water jet sand washers.** Anon. *Tonind. Ztg.*, **44**, 1270(1920).—A description of the Korting app.

16. **The current-temperature relation for different pyrometer filaments.** W. E. Forsythe. *Frank. Inst. J.*, **191**, 838–39(1921).—A test of the current-temp. relation was made in the case of tungsten and carbon pyrometer filaments and the ratios of currents were found to be very nearly the same for the temp. range from 1828°K to 950°K if the filaments were long enough so that the cooling due to end losses was negligible. Hence a pyrometer lamp with a carbon filament is not superior to a tungsten lamp in openness of scale. (*Sci. Abs.*)

17. **The exposition of apparatus for the control of combustion organized by the Office Central de Chauffe Rationelle (March 12–25, 1921).** Ch. Berthelot. *Rev. metal.*, **18**, 389–418(1921).—A detailed discussion, with many cuts, of some of the instruments displayed (recording manometers, gas meters, meters for liquids, steam, and coal, thermometers and pyrometers, gas analysis app., fuel calorimeters). The application of the data furnished by the instruments, and in some cases the theory of their operation, is discussed at length. A résumé is given of the work of the "Office central de chauffe rationelle." Donald W. MacArdle (*C. A.*)

18. **A furnace temperature regulator.** H. S. Roberts. Geophys. Lab. *J. Wash. Acad. Sci.*, **2**, 401–9(1921).—White and Adams' method (*C. A.*, **13**, 2304) of using furnace heating coil as a gigantic resistance thermometer in temp. regulation was followed with an attempt to substitute a better operating device. A galvanometer making direct elec. contacts with the boom is sensitive enough; two relays, one of them polarized, did the rest. Failure or sticking of the contacts gave trouble, which was avoided by putting in series with the galvanometer the secondary of a transformer whose primary current is

changed by each change in the relay current, thus giving a kick which throws the galvanometer boom away from the contact as soon as the relays are set. A lamp flasher in the primary circuit also gives occasional kicks in both directions, insuring against any lasting failure to either make or break of contact. The regulator holds its furnace coil resistance const. to an amt. corresponding to 0.1° for hrs., even with 6% variation in line voltage.

W P. WHITE (*C. A.*)

PATENTS

19. Analyzing gases. S. A. S. KROGH and P. H. PEDERSON. Brit. 169,130, May 10, 1920. Relates to app. for the automatic measurement of each of 2 or more constituents of a gas mixture, *e. g.*, CO_2 and CO in flue gases, etc. Two or more gas-analyzing units, each comprizing a "first" measuring vessel, an absorber, and a "second" measuring vessel, are connected in series, and the 2nd and subsequent "first" measuring vessels are adapted to restore the original vol. of the sample by the addition of air to the indrawn gas; direct readings in per cents and of reasonable accuracy are obtained. (*C. A.*)

20. Thermocouples, etc. W. C. HERAEUS GES. Brit. 168,977. June 9, 1920. Addition of 138,648(*C. A.*, **14**, 1806). Metals and alloys for thermoelec. purposes are melted and refined *in vacuo*, as described in the principal patent. The alloys used may be obtained from chemically pure metals. (*C. A.*)

Chemistry, Physics and Geology

21. Weldability of solid powders by pressure T. v. HAGEN. *Zeits. Elektrochem.*, **25**, 375–86(1919).—Expts. are made with a great number of pure inorg. substances (oxides, salts, sulphides, *quartz*, graphite), both hydrated and anhydrous, to ascertain whether they can be compressed to cohesive tablets or cylinders, and how appearance, hardness, and strength of the product depend upon the melting point, hardness, grain size of mat., upon the pressure, nature of binding agent (mostly water) and other conditions. The mats. were powdered (25 meshes per sq. mm.) and subjected generally to a pressure of 500 kg./cm.², small cylinders (0.5 gm. or less) being formed; in special expts. the pressure was raised from 560 to 9800 kg./cm.² The crushing tests of the products were pushed up to 230 kg./cm.²; harder tablets were tested by the sclerometer. The mats. are distinguished as non-weldable, powdery, smooth, homogeneous, plastic. Soft mats. (hardness up to 1.5) are generally plastic with hardness 1.5 to 2.5 homogeneous or smooth. Fine grains cohere better than coarse grains. As the melting point rises, the weldability decreases. Oxides give powdery bodies of low strength. Quartz and barium do not cohere at all. The d. increase with pressures may be regular (kaolin up to 7000 kg./cm.²) or more rapid at first than later; homogeneous bodies soon reach a max. d. In general weldability and plasticity (depending upon the number of gliding planes) go together. (*Sci. Abs.*)

22. Viscosity measurements. O. FAUST. *Zeits. phys. Chem.*, **93**, 758–761 (1919).—In detg. the viscosity of highly-viscous materials by the method of Cochius, an air bubble is introduced into a vertical tube, about 50 cm. high

and the rate of ascension of the bubble is measured. In such tests the width of the tube is not stated, as a rule. F. shows that for fairly wide tubes (15 to 21 mm. diam.) the tube diam. should be, and is, of no influence, and that in such tubes the size of the bubble is also immaterial, provided the bubble be approx. cylindrical and not pointed. In narrow tubes slight discrepancies may arise, because the bubble diam. $2r_1$ is a little smaller than the tube diam. $2r$, so that $(r + r_1)$, a sum entering into the calculations, is not quite equal to $2r$. (*Sci. Abs.*)

23. **Systems of color standards.** A. Ames, Jr. *Optical Soc. of Am.*, **5**, 160–70(1921).—Devices for enabling the color of any object to be detd. may be based either on the use of a colorimeter or a standard composed of colored cards. The latter method is much simpler and is considered in this paper. Such a standard must satisfy requirements as regards arrangement, nomenclature, number, spacing and standardization. All colors may be defined in terms of *hue* (wave length), *chroma* (saturation), and *value* (brightness). Munsell has devised the most perfect representation of colors in terms of these factors. In arranging the system, it is preferable to keep the value constant with changing color and saturation. Accordingly, all colors of the same hue or wave length are arranged on one chart, and a series of charts is provided. In the Munsell system *hue* is designated by a letter, *value* by a number above a line *t* to the right of the letter, *chroma* by a number below this line. The author concludes that there should be 50–80 steps in hue, 70–100 in value, 35–50 in chroma giving a total of about 13,000 different cards for complete analysis. As regards spacing, the deg. of sepn. should be the same throughout the entire system. Standardization should be effected by calcg. the 3 constants for each card and obtaining the conditions with a colorimeter, the results being produced on cards. In conclusion the author discusses Redway's system, which is probably the most used today, but does not completely satisfy the conditions prescribed for a color-standard. (*Sci. Abs.*)

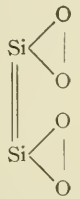
24. **Molecular heats at very high temperatures.** H. v. Wartenberg and G. Witzel. *Zeits. Elektrochem.*, **25**, 209–12(1919).—By burning in a bomb calorimeter Mg in the presence of a varying amt. of MgO the sp. ht. of MgO can be computed. The following results (±10–20%) for mol. ht. capacity (small cal.) at the abs. temps. indicated were obtained. MgO, 10.2, 415°; 14.5, 1683°. CaO, 11.6, 559°; 13, 1369°. Al_2O_3, 10.8, 230°; 29, 1308°. Ed.

25. **Silicic acid as a medicine.** Anon. *Tonind. Ztg.*, **44**, 431(1920).—See Trans., **19**, Abs. 132 (1920).

26. **Studies on sedimentation.** P. Rona and P. György. *Biochem. Zeit.*, **105**, 133(1920).—Non-electrolytes have marked influence on the sedn. velocity of kaolin.

27. **Atomic grouping and the optical rotation of quartz and sodium chlorate.** J. Beckenkamp. *Zeits. anorg. Chem.*, **110**, 290–310(1920).—The author discusses chiefly *quartz, christobalite* and *tridymite* and the influence of temp.

on these modifications and on their twinning. The twins are either of the Dauphinée type (both crystals of a pair alike) or of the Brasilian type (the two crystals differing as the left and right). Referring particularly to Groth, Sohncke and W. H. Bragg, he conceives that the 3-point helix is due only to the introduction of oxygen and not characteristic of silicon. The spiral grouping of the layers at right angles to the intermediate axes goes together with a spiral arrangement for layers at right angles to the main axes. The silicon atoms form a rhombohedral lattice; the disposition of the oxygen atoms is such that the orientation of their valency directions is the same in horizontal and vertical layers. The silica molecule is probably double, with the 2 Si vertically above one another. In the right- and left-handed crystals



the molecules are enantiomorphs of one another. Heating favors twinning of the Dauphinée type, not of the Brasilian type; that indicates that the Si and O of the same molecule are more strongly linked and less easily displaced than 2 molecules are. (*Sci. Abs.*)

28. Heating-curve study of rapid low-temperature reactions: barium oxides. J. A. Hedvall and N. v. Zweigbergk. *Zeits. anorg. Chem.*, **108** 119–36(1919).—Hedvall [*ibid.*, **104**, 163–68(1918)] had shown that while pure barium peroxide BaO_2 decomposed into oxide and oxygen at 800°, it liberates oxygen as low as 200° in the presence of silica. In the present paper it is shown that similar catalytic reactions take place in the presence of a great number of oxides (not only of acid character), and that there may be decomposition of the peroxide without formation of a compd. The expts. are made with masses of about 5 gm. in porcelain crucibles heated in gas furnaces, temps. being measured every 10 sec. by thermal couples. Of the oxides investigated, SnO, SnO_2, ZrO_2 had no effect. A purely catalytic oxygen liberation, without chem. reaction, was observed with CuO, MgO, CaO, CdO; mixed crystals might be formed. The oxides Ar_2O_3, Sb_2O_3, Cr_2O_3, Fe_2O_3, the various oxides of Mm, Ni, Co(?) were themselves higher oxidized; in the cases of Cu_2O, V_2O_5, Sb_2O_3, Cr_2O_3, MnO_3, MnO, the reaction velocity became enormous, between 200° and 300°. Alumina gave aluminate; lead oxide (litharge) did not liberate oxygen until near 500°, yielding a barium plumbate. (*Sci. Abs.*)

29. Cohesion. H. Chatley. *Phil. Mag.*, **40**, 213–17(1921).—C. proposes the empirical cohesion formula for the mean cohesions of hypothetical atom spheres, $t_2 = G_m^2/\delta^{2+n/k}$, where n is between 4 and 5, t_2 is the cohesion bond, k is the ratio (> 1) of mean atomic interval to that at absolute zero, while

G, m, and d are as in the Newtonian formula, for gravitational force. The mud resists erosion until the hydrodynamic tangential drag on a surface particle equals about 10^{-6} dyne; *i. e.*, each particle, containing some millions of molecules, is retained by at least one intermolecular cohesion bond, with the result that fine mud beds are not easily eroded, whereas coarser sand is easily moved. Also colloidal suspension and plasticity in gels becomes of importance when the wt. of particles is about equal to one inter-molecular cohesion bond, *e. g.*, with cubic particles, sp. gr. 2.5, each has a diameter $d = 10^{-6}/2.5^{-1} \times 981)^{1/3} = 9 \times 10^{-4}$ cm. This agrees with the dimension usually assigned as a max. to colloidal particles. (*Sci. Abs.*)

30. **Liquefaction of carbon.** E. Rishkevich. *Z. Electrochem.*, **27**, 445–52 (1921); cf. *C. A.*, **15**, 1432.—Pure C has been melted at ordinary pressure. Under favorable conditions (high current and good isolation) C can be brought into a molten state by using low c. ds. The drops formed on allowing molten C to cool consist of pure graphite. The sublimation point of C at ordinary pressure lies not far from its m. p. In satd. C vapor unusually large and excellent crystals can be formed. H. S. C. (*C. A.*)

31. **Kaolin in North Carolina, with a brief note on hydromica.** W. S. Bayley. *Econ. Geol.*, **15**, 235–46(1920).—The kaolins are found in pegmatite veins in the mountain regions and as blanket deposits derived from broad areas of igneous or metamorphic rocks in the Piedmont plateau. The downward gradation of the kaolin into pure feldspar in the pegmatic veins and retention of the characteristic texture of the pegmatite show that the kaolin occupies the place of the feldspar in the original pegmatite. Of the 3 generally accepted kaolinization processes of feldspar, it is believed that the true one in this case is downward traveling H_2O bearing dissolved CO_2 and org. matter along feldspathic dikes. The alteration of minerals other than feldspar includes soln. of quartz in some cases, possibly by alkalies. Beryl changes to scaly mica and kaolin. Biotite, hornblende, tourmaline, and other ferruginous minerals have altered to chlorite and hydrated micaceous minerals, limonite, and other Fe oxides, and to an Fe carbonate. A good specimen of so-called "hydromica" gives unsatisfactory and generally indefinite optical and chemical data and is believed to represent an aggregate of fine-grained decompn. products embedded in a matrix containing residual muscovite. Owing to water and increasing feldspar content the dikes can not usually be worked for kaolin to a greater depth than 95 feet. Analysis of feldspars, kaolins, and hydromica are given. A. B. Peck (*C. A.*)

32. **Studies on the gel of silicic acid.** R. Schwarz. *Kolloid-Z.*, **28**, 77–81 (1921).—A review of S.'s work (*C. A.*, **11**, 764; **14**, 1083, 1942; **15**, 214) with special reference to the colloidal phases. H. I. Mattill (*C. A.*)

33. **Chemistry of the earth's crust.** Henry S. Washington. Geophysical Lab. *J. Franklin Inst.*, **190**, 757–815(1920). (*C. A.*)

34. **Adsorption of gas by charcoal, silica, and other substances.** Henry Briggs. *Proc. Roy. Soc.* (London), **100A**, 88–102(1921).—The method of detg. the adsorptive capacity of a substance at liquid-air temp. is described,

and results are given of the capacity of silica and certain charcoals. They are compared, especially as relates to N and H, to illustrate preferential adsorption and to show the influence of chem. compn. on gas adsorption. The effect of compressibility of the initial layer, when the d. of the adsorbent is detd. by the immersion method, is considered. An evaluation is made of (*a*) vol. of solid matter, (*b*) that of the interstitial space between the granules, and (*c*) that of the internal gaseous space for silica and coconut charcoal. A high capacity silica may be deactivated, and in the inactive state remains porous. The evidence leads to the conclusion that de-activated silica is vitreous. It is argued that a vitreous solid, like a crystal, is a polymer, *i. e.*, a complete at. linkage. The importance of distinguishing between the coarser capillaries or canals and the finer interpolymeral openings of an adsorbent is emphasized. Activation is considered to be the effect of disrupting the solid polymers, and the means of accomplishing the partial depolymerization of charcoal and silica is described. E. P. WIGHTMAN (*C. A.*)

35. Determination of the valence scale of iron, cobalt, nickel, copper, manganese, tin and tungsten by means of water vapor equilibrium, and the dissociation pressure of the oxides of these metals. LOTHAR WÖHLER AND O. BALZ. *Z. Elektrochem.*, **27**, 406–19(1921).—The H_2O-vapor equil. over the phases Fe_2O_3/Fe_3O_4 and Fe_3O_4/FeO has been detd., at several temps., by the reduction of the higher and the oxidation of the lower stage (*i. e.*, from both sides), with a modified form of the app. previously employed by W. and Prager (*C. A.*, **12**, 554). Quant. measurement of the accompanying quantity of H and the detn. of special equil. for each oxide show that the stability of the oxides of Fe follows the order of chem. valence: Fe_2O_3, Fe_3O_4, FeO. It has been found that FeO is formed at red heat from Fe and H_2O, and not a mixt. of Fe and Fe_3O_4. In agreement with Hilpert and Beyer (*C. A.*, **5**, 2785), it has been found that reduction of Fe_2O_3 first begins between 280 and 330°, according to the mode of prepn. of the oxide. The heat of reaction of the processes, $Fe+O=FeO$ and $3FeO+H_2O=Fe_3O_4+H_2$, has been calcd. by means of the van't Hoff equation for the reaction isochore for different temp. intervals. The dissoc. pressure of the different oxides has been calcd. from the equil. consts. and the formation consts. The values obtained are very small, and for the oxides of Sn, of Fe and of W, have values between 10^{-11} and 10^{-12} mm. Hg at 1000°. H. JERMAIN CREIGHTON (*C. A.*)

36. Feldspar in 1920. L. M. BEACH. U. S. Geol. Survey, *Mineral Resources of U. S. Geol., 1920*, Part II, 153–4(preprint No. 18, published Oct. 29, 1921). E. H. (*C. A.*)

37. The estimation of small quantities of lime in presence of large quantities of magnesia. J. S. F. GARD. *Proc. Univ. Durham Phil. Soc.*, **5**, 234–5 (1915).—If the pptn. of CaC_2O_4 takes place in dil. soln. contg. considerable NH_4Cl and dil. AcOH, it is possible to effect satisfactory sepn. of a little Ca from considerable Mg. To a soln. contg. the equiv. of 5 g. MgO in water or dil. HCl, add 5 g. of NH_4Cl and NH_4OH until alk. Filter off the $Fe(OH)_3$, etc., make the filtrate acid with AcOH, using a moderate excess, and dil. to 450 cc.

At the boiling temp., add 50 cc. of a cold satd. soln. of $(NH_4)_2C_2O_4$, continue boiling 5 min. and allow to stand 20 hrs. Decant off the supernatant Mg soln., dissolve the CaC_2O_4 in 6 *N* HCl and repeat the pptn. as before beginning with the neutralization by NH_4OH but allowing this ppt. to stand only 30 min. If the ppt. cakes or sticks to the glass repeat the process once more.

W. T. H. (*C. A.*)

38. **Physical chemistry of the oxides of lead. I. Solubility of lead monoxide.** S. Glasstone. *J. Chem. Soc.*, **119**, 1689–97(1921). (*C. A.*)

39. **General colloid chemistry. III. The physico-chemical analysis of zirconium oxychloride and of zirconium oxide sols.** Mona Adolf and Wo. Pauli. *Kolloid-Z.*, **29**, 173–84(1921). (*C. A.*)

40. **The colloidal state and colloidal terminology.** A. A. Pollitt. *Chem. Age* (London), **5**, 586–8(1921).—A review. E. H. (*C. A.*)

41. **Preparation of zirconia.** Anon. *Chem. Trade J.*, **68**, 1745(1921).—Equal parts zirkite and caustic soda were fused in an iron crucible, the final temp. being visible redness. The product was treated with water, filtered, and the residue treated with HCl and evapd. to dryness. The insoluble material after ignition amounted to 20% of the zirkite used and contained 61% ZrO_2, 29% SiO_2, 1% Fe_2O_3, and 2% Al_2O_3. The zirconia was precipitated from the soln. as the easily filtered basic sulphate. The ppt. was amber colored, easily soluble in conc. H_2SO_4, slightly in HCl and was completely decomposed by boiling with sodium carbonate of ammonia. The hydroxide precipitated by ammonia was dissolved in HCl, evapd. and allowed to cryst. forming needle-like $ZrOCl_2.8H_2O$. A quantitative separation of zirconia from large amts. of iron was found possible.

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42. **Contact body with ceramic material as carrier.** V. Zieren. Ger. 317,979, Oct. 25, 1917. The contact body consists of a thin-walled porous member provided with channels to permit the passage of gas, and in certain circumstances with projections. The walls are covered completely with contact substance. The thickness of the walls does not exceed 2 mm., and the cross-section is not more than 20 mm. (*C. A.*)

43. **Soluble compounds from feldspar.** H. S. Blackmore. U. S. 1,355,381, Oct. 12. Finely divided orthoclase or a similar material is heated under pressure with a soln. of Al silicofluoride for 3–5 hrs. to form K_2SiF_6. Insol. matter is sepd. and the soln. is allowed to cool to effect deposition of K_2SiF_6. The aluminous residue obtained as a by-product may be employed as a china clay for manuf. of crockery. Na_2SiF_6 and $(NH_4)_2SiF_6$ also may be used instead of $(Al)_2(SiF_6)_3$. This method avoids the disadvantage of corrosive action of HF on the app. such as may occur when H_2SiF_6 is used to decompose silicates. U. S. 1,355,588 relates to a similar method in which $FeSiF_6$ is used as the decomposing agent with or without the addition of $(NH_4)_2SiF_6$, in obtaining sol. compds. from orthoclase, leucite, glauconite or similar minerals. The reaction is preferably carried out under 200 lbs. pressure per sq. in. at a temp. of about 175°. (*C. A.*)

44. Increasing the adhesive properties of alkali silicate solutions. W. Daiise. Ger. 318,516, Aug. 23, 1918. Alkali silicate solns. are treated with solns. of water-sol. Zn or Cd salts. *E. g.*, to Na_2SiO_3 soln. of 36° Bé., are added gradually, with continued stirring 0.6–1% of $ZnCl_2$ which has been previously dissolved in 10 times its weight of H_2O. At first a gelatinous mass seps. which during the progress of the reaction is converted into a viscous, strongly adhesive mass. (*C. A.*)

45. Aluminium oxide. H. J. Goldschmidt. U. S. 1,354,824, Oct. 5. Plagioclases of the labradorite-anorthosite series or other materials containing Al and other metals such as Ca, K and Na are treated with HNO_3 and the nitrates formed are subjected to a temp. of about 300° in order to convert the $Al(NO_3)_3$ into oxide without affecting the other nitrates. Cf. *C. A.*, **14**, 1598. (*C. A.*)

46. Magnesium carbonate. B. B. Grunwald. U. S. 1,361,324, Dec. 7. Calcined magnesite is hydrated with H_2O and the liquid mass thus obtained is subjected to the action of CO_2 under pressure to produce $MgCO_3$ and $Mg(HCO_3)_2$ in the form of a milky mixt. Calcined magnesite is added to the mixt. as it comes from the digester with an excess of CO_2 in soln. and the mixt. is agitated and heated to ppt. basic Mg carbonate. (*C. A.*)

47. Apparatus for producing magnesium carbonate from calcined magnesite. B. B. Grunwald. U. S. 1,361,325, Dec. 7. The app. comprizes a hydrating chamber to which a supply of CO_2 is connected, a heated pptg. device and other devices adapted for carrying out the method described in U. S. 1,361,324 (preceding pat). (*C. A.*)

Refractories and Furnaces

48. The magnesite plant of Austro-American Magnesite Company at Radenthein (Kärnten). K. Endell. *Met u. Erz.*, **18**, 597–600(1921).—The plant manuf. dead-burned magnesite and magnesite brick. The raw mag. is calcined (1700°C) in revolving fur. The mag. brick are pressed under 1000 kg. per sq. cm. and fired in a tunnel kiln to 1500°. Total employees number 910. The prod. of d.b. mag. is about 1,115,000 tons and that of mag. brick about 21,000 T. per annum. A Cottrell precip. app. is in process of installation in the revolving fur. Ed.

49. On the application of generator gas-firing in the ceramic industry. K. Teichmann. *Ber. D. K. Ges.*, **1** (3), 32(1920).—The writer claims that with the recuperative system kiln temperatures up to cone 16 can be obtained, using a gas manufactured from low grade brown coals. The writer also claims that the value of the tar produced in one year would pay for the initial cost of installation.

50. What happens during firing. R. Seydel. *Tonind. Ztg.*, **44**, 951(1920).

51. Thermal "balance-sheet" of an annular kiln. R. Claus. *Tonind. Ztg.*, **44**, 1009(1920).

52. **Firing with artificial draught.** H. Sa. *Tonind. Ztg.* **44,** 1045(1920).—Description of grates with injectors and air pipes, nozzle app., adjustable steam distributors, etc.

53. **The "Herda" kiln.** Anon. *Sprech.*, **53,** 535(1920).—The hot air from the cooling chambers is mixed with the gases of combustion from the chambers under fire, thus insuring complete combustion of all carbonaceous matter before the hot gases reach the ware to be preheated.

54. **Practical economies in firing pottery.** E. Reutlinger. *Ber. D. K. Ges.*, 1(3), 20(1920).—A general discussion for the purpose of promoting coöperation between the German Ceramic Society and the Society of Heat Engineers.

55. **Heat saving investigation on kilns.** E. Reutlinger. *Ber. D. K. Ges.*, **2,** 33(1920).—Field tests were made on 16 annular kilns in diff. ceramic plants. The preliminary results indicate that: (1) the firing period is too long; (2) fuel consumption is too high; (3) firing is irregular; (4) per cent of rejection is too high. In almost all cases the defects can be removed by comparatively simple means. In one case the firing period was reduced from 32 to 24 hours and the chem. constn. of the flame kept under control during both the oxidation and reducing periods. The work is being continued under the auspices of the German Ceramic Society for the purpose of discovering defects and making improvements and of training the workmen, the introduction of systems of control and permanent inspection and supervision of firing.

56. **Theory of the carbon gasification process.** Wo. Oswald. *Chemiker Zeit.*, **43,** 229–31(1919).—When carbon is gasified on the grate or by the aid of steam in a producer, 8 reactions may take place which may be summed up in 3 equations. (1) $C+O_2=CO_2+97.6$ cals.; (2) $C+2H_2O=CO_2+2H-18.8$; (3) $C+CO_2=2CO-38.8$. When these reactions take place in the proportions a, b, c, the complete process is: $(a+b+c)\,C+aO_2+2bH_2O=(a+b-c)\,CO_2+2bH_2+2cCO+97.6a-18.8b-38.8c$. The presence of CH_4 and of N is disregarded. Only 2 of the 3 quantities a, b, c, are independent variables. They are detd. by analyses and the results are plotted by the triangular coördinates of Gibbs. The triangle is divided into regions of combustion and gasification, and of regeneration. The author shows how isothermals and isocalorics are diagrammatically represented, and how the chemist may det. the thermochemical and volumetric characteristics of combustion under varying working conditions, the amt. of coal consumed, the heating value of the gas produced, etc. (*Sci. Abs.*)

57. **Refractory crucibles.** Anon. *Metal. Ind.*, **17,** 369(1920).—Crucibles can be manufd. by tapping plastic mixts. of highly refractory oxides into fire-clay mould lines with plaster of Paris and then firing the crucible and the mould to a red heat. The crucible can then be removed and given a further firing at high temp. Another method is to use linseed oil as a temporary binder, the crucible being shaped in a metal mould. Crucibles have been made in this way from TiO_2ZrO_2 and CaC.

58. The separation of mineral matter from natural flake graphite. W. C. Ratliff and J. D. Davis. *Chem. Met. Eng.*, **23**, 1027–8(1920).—Expts. show that while graphite flake or amorphous, may be cleaned by agitation with oil and water, light volatile liquids such as C_6H_6, C_7H_8 and CCl_4 are even better. The agglomerates formed with the volatile liquids are less viscous and the mineral matter is sepd. with less agitation than in cases where heavy oil has been used. Fineness has a direct bearing upon the effectiveness of the cleaning. W. H. Boynton (*C. A.*)

59. Stability of conducting (electric) furnace hearth structures. F. Hodson. *Elec. Rev.* (Chicago), **79**, 911–2(1921).—The conductive hearth of the Greaves-Etchells furnace has given exceptionally good service. One of the furnaces installed in June, 1907, has worked continuously with the production of thousands of casts and is still in operation on the original hearth. In one of the large works the practice is followed of chipping out about 4 or 5 in. of the top surface of the hearths once a month and re-ramming new material in. This is done more as a metallurgical precaution to insure clean steel, but the real linings of these furnaces have not been changed for years. There is no doubt that a hearth of this type, when intelligently installed and maintained is practically permanent. In the Greaves-Etchells furnace, 2 phases of the 3-phase current are taken through top electrodes and the third phase is connected directly to a Cu plate lying underneath the lining. No studs project into the lining, and after putting a few inches of special C compd. over the Cu plate, the whole lining of standard *dolomite* or *magnesite* is rammed in with sufficient tar to bind. Details are given. C. G. F. (*C. A.*)

60. Silica brick for coke ovens. A. H. Middleton. *Colliery Guardian*, **122**, 1203–4(1921).—Silica brick is not used extensively in Great Britain for lining coke ovens as it is in U. S. This is a discussion of the present developments in the use of this material for ovens. Also in *Gas World*, **75**, No. 1946 (Coking and By-products Sec.), 13–17(1921); *Gas J.*, **156**, 630–1(1921). C. A. Davis (*C. A.*)

61. Firing with brown coal. Anon. *Tonind. Ztg.*, **44**, 1148(1920).—Two illustrations are given of a method of firing boilers with step grates.

62. The reconstruction of grates for firing with lignite and briquettes. O. Schöne. *Tonind. Ztg.*, **44**, 1185(1920).

63. Refractories in the steel plant. A. A. Hull. *Iron Age*, **25**, 1377–8 (1921).—A plea for adequate specifications and coöperation between producer and consumer. E. H. (*C. A.*)

64. War experience with refractory bricks in the German navy. Schulz. *Tonind. Ztg.*, **44**, 1047(1920).—Specifs. include the following softening points: cone 34 for grade 1, cone 31 for grade 2, cone 26 for grade 3.

65. The refractory products industry. J. Bied. *Cer.*, **22**, 33(1919); See Trans., **19**, 134(1920).

66. Refractories for electric furnaces. *Iron and Coal Trades Rev.*, **101**, 616(1920).—A symposium held by the Electric Furnace Association, Columbus, Ohio.

67. **Firing temperatures attainable with wood.** H. Sachse. *Tonind. Ztg.*, **44**, 709(1920).—The actual temp. reached in practice with dry wood is approx. 1450°C, with air dried wood containing 20% water, approx. 1000°C and with green wood, approx. 700°C.

68. **Firing with coal dust—a solution of the fuel problem.** C. Degelow. *Tonind. Ztg.*, **44**, 752, 767(1920).—A rept. on Amer. experience with powdered coal as a fuel.

69. **Coal saving.** W. Englehardt. *Tonina. Ztg.*, **44**, 877(1920).—A few general remarks chiefly concerning the regulation of draught.

70. **Heat saving in revolving kilns.** E. Schott. *Tonind. Ztg.*, **44**, 781 (1920).—The author recommends a combined rotary-grate, revolving, tubular kiln.

71. **Design of open hearth furnaces.** A. D. Williams. *Iron Age*, **105**, 35, 119(1920).—A thorough discussion of the whole subject.

72. **A war-time lime kiln.** W. Hänse. *Tonina. Ztg.*, **44**, 717(1920).

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73. **Electric insulating compositions.** Blériot, Ltd. Brit. 147,746, July 8, 1920. A compn. for elec. insulation, especially designed for use with elec. heating and cooking app., consists of carborundum with a soln. of K_2SiO_3 or Na_2SiO_3 as a binding medium, with or without the addition of washed sand and powdered quartz or glass. The mixt. is baked at a temp. of 400–500°. (*C. A.*)

74. **Furnaces.** H. J. F. Philipon. Brit. 164,746, May 30, 1921. Thin tubes of fused quartz are employed in the construction of regenerators. (*C. A.*)

75. **Making films of silica, alumina, etc.** M. De Roïboul. Brit. 169,136, Nov. 19, 1920. Relates to drawing films of SiO_2, Al_2O_3, or like refractory substance having a thickness of the order of 0.001 mm. and a width of about 6 cm. Such films are strong and flexible. The app. employed is generally similar to that described in 165,052 for the drawing of filaments. Pairs of parallel wires of Ir, etc., passed over pulleys and wound on a drum draw up a film from a bath of the molten material. The drawing may be started by a cross wire. The wires may be cut away from a film when it is subsequently unwound from the drum, or they may be severed from it as it is wound on to the drum. (*C. A.*)

76. **Refractory material.** O. Hutchins. U. S. 1,362,316, Dec. 14. A refractory material suitable for furnace linings, crucibles or muffles is formed of a burnt mixt. of zirconia and alumina. (*C. A.*)

77. **Basic refractory composition.** H. P. Bassett. U. S. 1,360,355, Nov. 30. A basic refractory compn. suitable for lining open-hearth furnaces or Bessemer converters is formed of magnesium limestone 100, Fe scale or oxide 1–2, NaCl 2 and SiO_2 2–10 parts, heated to a high temp. and prepd. in granular form. (*C. A.*)

78. **Improvement of furnace using gaseous fuels.** A. C. Ionides, Jr. Japan 35,862, Feb. 21, 1920. (*C. A.*)

79. **Furnace lining.** J. F. Mollen and W. W. Patnoe. U. S. 1,356,336, Jan. 11. A material adapted for lining furnaces is prepd. by making a slurry of raw dolomite, adding a small per cent of NaCl and then passing the mixt. through a rotary kiln operated at a temp. sufficiently high to calcine the dolomite and volatilize the NaCl. The presence of the NaCl serves to maintain the material in granular form. (*C. A.*)

80. **Temperature-control devices for electric furnaces.** E. F. Collins. U. S. 1,391,996, Sept. 27. Automatic devices are specified for successively maintaining different predetd. temps. in elec. furnaces such as those used for heat-treating steel or other metals. (*C. A.*)

81. **Insulating and heat-conducting material for electric heaters.** R. W. Earle. U. S. 1,358,366, Nov. 9. An elec. insulating and heat-conducting material for elec. heaters is formed of a granular material of high dielectric strength and thermal concd. such as fused Al_2O_3 85% mixed with refractory clay 15% or similar bonding material of high dielectric strength and high fusing point and capable of forming a viscous mixt. with H_2O. (*C. A.*)

82. **Refractory and protective coating on furnace linings.** E. R. Stowell. U. S. 1,350,343, 1920. Mix 8 lbs. powdered SiC with 1 gal. of a 4% soln. of NaOH with water, stir and add 1 pt. of a 50% Be soln. of sodium silicate.

See Abs. 41.

Abrasives

83. **The crystalline characters of calcium carbide.** C. H. Warren. Mass. Inst. Technology. *Am. J. Sci.*, **2**, 120–128(1921).—CaC_2 from the elec. fur. is a granular or columnar-cryst. aggregate, geometrically pseudo-cubic, but intricately twinned. True symmetry probably orthorhombic, or perhaps tetragonal. Cleavage perfect in three mutually perpendicular directions. Twinning highly polysynthetic; grains are made up of groups of lamellae, parallel to cleavage or at 45°. Color by transmitted light purplish red or lilac-yellow. Transparent only if less than 0.02 mm. thick. Indices of refraction above 1.75; double refraction above 0.050. (For further details on interference figures, etc., see original.) The reaction with water to form C_2H_2, when it is made to take place slowly, leaves the microscopic structure undisturbed. *Calcium cyanamide* is usually also present. Properties: rhombohedral symmetry and cleavage; colorless; refractive indices: $\omega = 1.60$, ϵ, very large; double refraction unusually large, over 0.35; optically positive.

R. B. Sosman

84. **Abrasive materials in 1920.** L. M. Beach and A. T. Coons. U. S. Geol. Survey, *Mineral Resources of U. S., 1920*, Part II, 155–9(preprint No. 19, published Oct. 28, 1921). E. H. (*C. A.*)

Stoneware, Whiteware and Porcelain

85. **Kaolins and pottery clays in the U. S.** A. V. Bleininger *Brick Clay Record*, **60**, 39–42(1922).—Eng. china clay in 1 : 1 clay-flint mixts. has a dry transverse strength of 35 lbs. per sq. in. and an absorption of 24% when fired

at cone 8. In similar mixts. N. Car. kaolin has a transverse strength of 25.5 lbs. per sq. in. and an absorption of 25.5% when fired at cone 8. The primary clays in this country are not always of high quality because of improper refining methods. Fla. kaolin develops a stronger body than Ga. kaolin. For example in 1 : 1 clay flint mixts. Fla. kaolin has a transverse strength of 250 lbs. per sq. in. while Ga. kaolin has a dry strength of 25 lbs. per sq. in. Ga. clays develop considerable cracks and checks in drying. Ball clays may be divided into five classes as follows: (1) Black and dark ball clays containing considerable organic matter, inclined to be sticky and vitrify below cone 8. In 1 : 1 clay flint mixts. the transverse strength is about 475 lbs. per sq. in. (2) Dark ball clays having the same physical properties as class 1 except that they vitrify above cone 8 but not above cone 10. (3) Blue, gray or yellowish clays, much lower in org. matter than the black clay. The dry strength of the 1 : 1 clay flint mixts. have a transverse strength of 350–400 lbs. per sq. in. and vitrify below cone 8. (4) Clays similar to class 3 except that they vitrify above cone 8 but not cone 10. (5) Clays similar to class 3 and 4 but having a transverse strength of 240–350 lbs. per sq. in. and vitrify between cones 11–12. It is desirable for the ball clay to vitrify during the bisque fire since more refractory clays tend to produce more open and less strong bodies which are apt to craze. No clay which fires to a gray should be used. In cream colored clays, however, this tinge may be neutralized with cobalt. The requirements of a good feldspar are as follows: (1) The spar should have a silica content of not over 69%. (2) The potash should not be below 9%. (3) The soda content should not be above 3%. (4) The spar fired at cone 8 should be thoroughly fused but not flatten out or change its shape markedly. (5) The color of the fired spar should show a white and not a gray-black color and should not show an excessive no. of specks. The sagger clays may be classified as follows: (1) Those having a drying shrinkage of 7% and a fire shrink. at cone 8 of 5.5%; absorption at cone 8 2.5%, transverse strength in the dry state of 120 lbs. per sq. in. They have good strength in the first fire but overburn gradually and sometimes soften in subsequent firings. (2) Drying shrink. 6.2%, fire shrink. 3.4%, absorption at cone 8 is 12%, dry strength is 120 lbs. per sq. in. Does not overfire but continues to shrink on firing. (3) Drying shrink. 7%, fire shrink. 6.8%, absorption 2.3%, dry strength 220 lbs. per sq. in. Does not shrink or overfire in repeated firings. (4) Dry shrinkage 4%, fire shrink. 4%, absorption at cone 8 is 15%, strength is 80 lbs. per sq. in.; is quite high in silica and does not overfire. Clays 1, 2 and 3 give best results. H. G. SCHURECHT

86. Stoneware cooking utensils. E. TUSCHOFF. *Tonind. Ztg.*, **44,** 729 (1920).—Description of the process of manuf.

87. Stoneware pipes. ANON. *Tonind. Ztg.*, **44,** 666(1920).—The thinner pipes made in Germany for export have more even and dense bodies than the thick walled ones made for the home market.

88. Clay or stoneware utensils for poultry farms. A. WULF. *Sprech.* **53,** 442(1920).

89. **The packing of Gay-Lussac towers.** GEORGE SCHLIEBS. *Chem.-Ztg.*, **45**, 1038–9(1921).—Manufd. *stoneware* packing is superior to coke on every count. Such a packing must, however, be as light as possible without crushing under its own wt., must be entirely acid-proof and should possess rough walls. A patented packing consisting of a small cylinder made integral with and inside a larger cylinder is described. F. C. Z. (*C. A.*)

90. **Hard stoneware body for electric insulators.** ANON. *Sprech.*, **53**, 533(1920).—The following body fires satisfactorily at cone 6–8:

$$\left.\begin{matrix}0.56\ KNaO\\0.44\ Ca(Mg)O\end{matrix}\right\} : 1.6\ Al_2O_3 : 9.2\ SiO_2$$

91. **High tension insulator porcelain.** W. D. A. PEASLEE. *J. Amer. Inst. E. E.*, **39**, 445(1920).—The subject is discussed under the following headings: (1) mechanical strength, (2) ability to resist sudden changes in temp., (3) porosity, (4) temp. resistivity coeff., (5) Piezo elec. effect, (6) surface leakage as a factor in insulator design.

92. **Firing stoneware pipes.** W. SCHUEN. *Tonind. Ztg.*, **44**, 1001, 1035 (1920).—A method of arriving at a thermal balance sheet.

See Abs. **14**, **119**.

Glass

93. **Double refraction of glass under pressure.** E. AND MME. HENRIOT. *Comptes Rendus*, **172**, 1477–79(1921).—The dispersion produced in crown glass is not independent of wave-length, but it obeys very closely Havelock's law that the expression $n(n'-n'')/(n^2-1)^2$ is constant where $n'-n''$ is the dispersion produced at wave-length n. (*Sci. Abs.*)

94. **Copper ruby glass for casing.** J. BALDERMANN. *Sprech.*, **53**, 491 (1920).—A discussion of batch compn. and methods of melting.

95. **Copper ruby glass for casing.** E. S. *Sprech.*, **53**, 536(1920).—A reply to Baldermann—see above.

96. **Circular flattening ovens and lehrs for plate glass, bottles, etc.** C. BALDERMANN. *Sprech.*, **53**, 444(1920).—A description with sketch.

97. **The manufacture of optical glass.** C. J. PEDDLE. *Trans. Opt. Soc.* **23**, 2 (1921–22).—The history of the manuf. of opt. glass is discussed under the headings, (1) *early attempts*, (2) 1790–1886, (3) 1886–1914, (4) 1914 onward. Except for the bibliography the discussion of the 4th period is confined to developments in England. A good outline descrip. of the meth. of manuf. is given. Nine excellent photomicrographs of various types of stones are reproduced. The reln. between properties and compn. are displayed in the following diagrams:

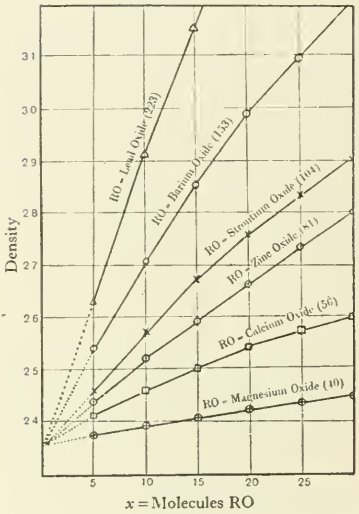

Fig. 1.

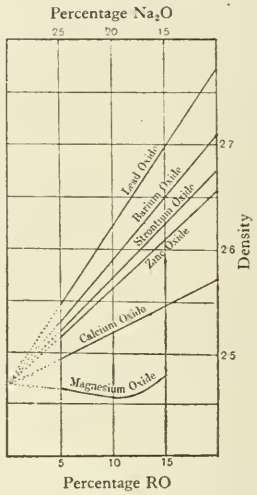

Fig. 2.

Fig. 1.—Relationship between molecular composition and density in the series 100 mols. SiO_2 . 20 Na_2O . xRO.

Fig. 2.—Percentage composition and density (silica constant = 70 per cent).

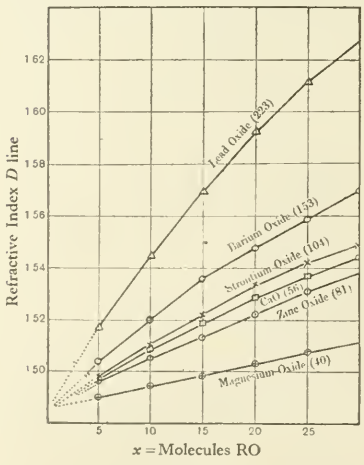

Fig. 3.

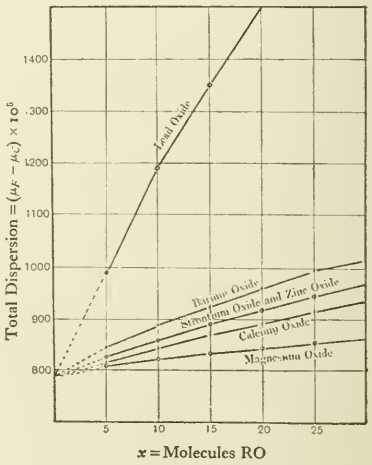

Fig. 4.

Fig. 3.—Relationship between molecular composition and refractive index (μ_D) in the series 100 mols. SiO_2 . 20 Na_2O . xRO.

Fig. 4.—Relationship between molecular composition and total dispersion in the series 100 mols. SiO_2 . 20 Na_2O . xRO.

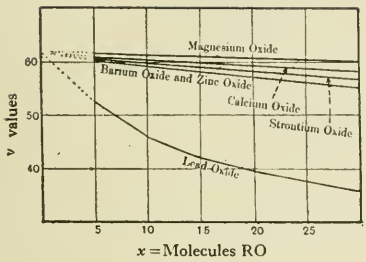

FIG. 5.

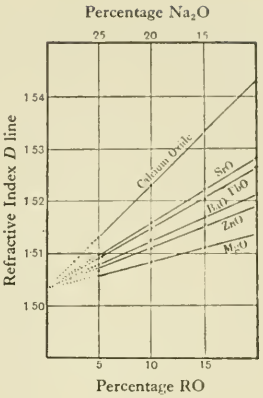

FIG. 6.

FIG. 5.—Relationship between molecular composition and ν value in the series 100 mols. SiO_2 . 20 Na_2O . xRO.

FIG. 6.—Relationship between percentage composition and refractive index. (Silica constant = 70 per cent.)

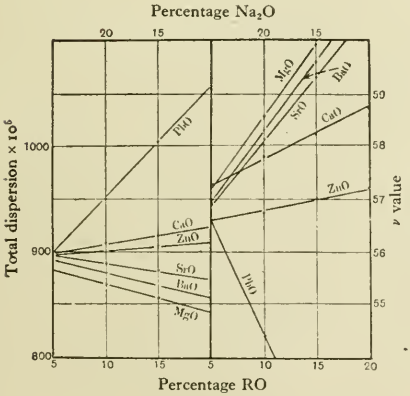

FIG. 7.

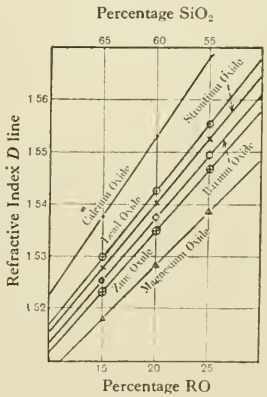

FIG. 8.

FIG. 9.

FIG. 7.—Relationship between percentage composition and total dispersion. (Silica constant = 70 per cent.)

FIG. 8.—Relationship between percentage composition and ν value. (Silica constant = 70 per cent.)

FIG. 9.—Percentage composition and refractive index. (Sodium oxide constant = 20 per cent.)

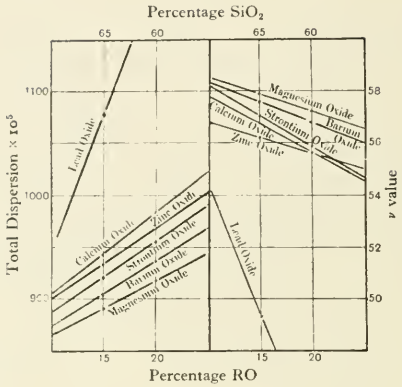

FIG. 10. FIG. 11.

FIG. 10.—Percentage composition and total dispersion. (Sodium oxide constant = 20 per cent.)

FIG. 11.—Percentage composition and ν value. (Sodium oxide constant = 20 per cent.)

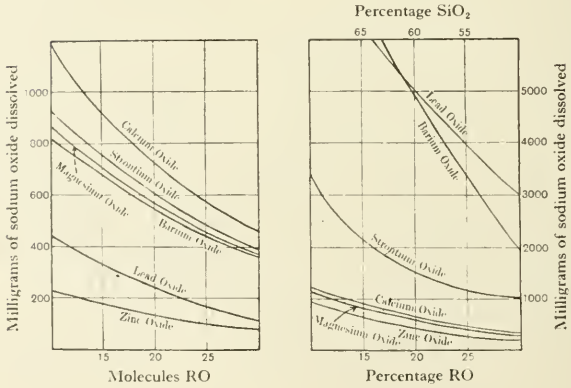

FIG. 12. FIG. 13.

FIG. 12.—Molecular composition and solubility of glasses. 100 SiO_2 . 20 Na_2O . xRO.

FIG. 13.—Percentage composition and solubility. (Sodium oxide constant = 20 per cent.)

98. Strains in unannealed glass. J. Salpeter. *Zeits. techn. Physik.*, I, **10**, 221–24(1920).—This paper gives further theoretical treatment of the case of a quickly cooled sphere of glass dealt with in a previous paper. (*Sci. Abs.*, **1359**, 1920). (*Sci. Abs.*)

99. High-frequency losses in glasses and other dielectrics. E. Schott. *Jahrb. d. Tele.*, **18**, 82–122(1921). (Extract from Dissertation, Jena.)—For detg. the "angles of loss" of dielectrics in high-frequency fields a method was employed in which a direct comparison was made of the condenser (made up with the dielectric to be investigated) with an air condenser free from losses, and previously calibrated resistance. The angles of loss (in minutes of arc) found for the different substances dealt with are given as follows: glass, 1.5 to 90; quartz, 0.4; good mica, 0.6; pressed amber, 18; presspan, about 100. *Temperature effect.*—The increase of the angle of loss with temp. for glasses is very marked. At the highest temp. employed (about 400°C) the loss can be assigned to pure conductivity. At ordinary room temp. the loss calcd. from the d.c. resistance was generally much less than 1% of the observed h.-f. loss. (*Sci. Abs.*)

PATENTS

100. Method of operating optical pyrometers. E. A. Keeler. U. S. 1,379,188, May 24. (*C. A.*)

101. Apparatus for analyzing flue gases. Herbert M. Sharp. Can. 211,201, May 3, 1921. The app. consists of an elec. circuit, a receptacle contg. conducting liquid, in which electrodes are submerged, a conduit delivering gas into the liquid and past one of the electrodes so that the gas bubbles emerging from the conduit press the conducting liquid away from the electrode and interrupt the circuit and means controlled by the circuit for indicating the number of interruptions. A desired number of such receptacles is connected in series, each contg. an absorbent for a particular constituent of the gas. (*C. A.*)

102. Putting the glass industry on a scientific basis. E. Ward Tillotson. *Chem. Met. Eng.*, **23**, 461–5(1920).—A general discussion of the problems of the glass industry with the improvements which have been made, particularly by substitution of continuous and machine processes for intermittent and hand processes. Contributions of American inventors are noted and a plea is made for the scientific coöperation between the practical glass maker and the technologist necessary for adequate plant control and research.

J. S. Laird (*C. A.*)

103. Annealing of glass. L. H. Adams and E. D. Williamson. Geophys. Lab. *J. Franklin Inst.*, **190**, 597–631, 835–70(1920).—In order to anneal glass properly the rate of release of the internal stresses must be known for the various glasses and the various temps. A record is given of such measurements for 9 kinds of glass; and mathematical formulas are derived for calcn. of the release of stress, and for calcn. of the stresses due to heating or cooling various shapes of glass. At any temp., a glass requires a certain annealing time which is arbitrarily defined as the time required to reduce the

stress, in optical units, from 50 to 2.5 micromicrons per cm. The annealing range is the interval of 150° lying immediately below the temp. at which the annealing time is 2 min. Very little permanent stress can be introduced at temps. below the annealing range. Concrete directions are given for annealing various kinds of glass; the best procedure is to hold the glass at a const. temp. at the annealing point for the proper time, then to cool at an increasing rate. JOSEPH S. HEPBURN (*C. A.*)

104. Glass blowing. Internal welding. H. VIGREUX. *Chimie & industrie*, **4**, 334–6(1920).—The difficulties of internal glass welding are discussed and directions for this operation are given. Cf. *Jour. Am. Ceram. Soc.*, **3**, 932. E. H. (*C. A.*)

105. Composition of acid paste. ANON. *Schnurpfeil's Rev. Glass Works* **4**, 669(1920).—This acid paste is recommended for fine designs: Powdered K_2SO_4 11, KF 20, HCl 11, HF 3, flour 22. ROBERT J. MONTGOMERY (*C. A.*)

106. Silica-glass prism for refractometry of liquids at elevated temperatures. F. R. v. BICHOWSKY AND H. E. MERWIN. *J. Optical Soc. Am.*, **5**, 441–3(1921).—A method is given for the construction of a small hollow fused-silica prism for the refractometry of liquids at elevated temps. An elec. heated furnace to be mounted on a goniometer for use with such prisms also is described. Values are given for the *refractive index* and *dispersion of glacial acetic acid*, *α-chloronaphthalene*, and const. boiling *sulfuric acid* from room temps. to near the b. p. F. R. B. (*C. A.*)

107. The manufacture of glass with indigenous alkali. J. P. SRIVASTAVA. *J. Indian Industries and Labor*, **1**, 333–40(1921).—Alkali manufd. from a natural Na_2CO_3 occurring during the dry season in India as a surface efflorescence can be used in the manuf. of colored glass, thus reducing the cost by 30%. The incrustations in which Na_2CO_3 predominates are known as "*reh*" or "*sajji-matti*." The following per cent compn. represents an av. of more than 500 tests: Insol. matter 3.3–8.4, Na_2CO_3 48.2–60.2, NaCl 0.2–4.3, Na_2SO_4 0.3–7.2, H_2O 30.3–38.2, together with a small quantity of org. matter. A careful selection of the deposits is necessary to keep the NaCl content at a minimum. This indigenous soda can be purified on a com. scale to yield a product contg. 90–95% Na_2CO_3 which competes successfully with imported soda ash as a raw material for the production of colored glass.
J. B. PATCH (*C. A.*)

108. Optical glass. F. WEIDERT. *Umschau*, **25**, 534–40(1921); 4 figs.—A brief description in non-technical language of the history and operation of the optical glass firm of C. P. Goerz A.-G. of Munich. J. B. PATCH (*C. A.*)

109. Cornu's method of determining the elastic constants of glass. H. T. JESSOP. *Phil. Mag.*, **42**, 551–68(1921).—Certain errors in Cornu's exptl. arrangement are pointed out, and new measurements are reported for a number of different glasses using an improved method. The change of Young's modulus with time is definitely established. S. C. LIND (*C. A.*)

Heavy Clay Products

110. Standard and tentative methods of sampling and testing highway materials. T. R. Agg and A. T. Goldbeck. Bur. Public Roads. U. S. Dept. Agr., *Bull.* **949**, 1–98(1921).—A full text description is given of the methods which the Committee of the Am. Assoc. of State Highway Officials have recommended as official and which have been approved by the Bur. of Public Roads. W. H. Ross *(C. A.)*

111. Manufacturing cost of bricks. Anon. *Tonind. Ztg.*, **44**, 653(1920).

112. The crushing strength of whole and perforated bricks. Hielscher. *Tonind Ztg.*, **44**, 878(1920).—The author gives figs. showing that the perforated bricks are 20% stronger than the whole bricks, owing to their denser condition and more thorough firing.

113. A chainless carrier. Anon. *Tonind. Ztg.*, **44**, 886(1920).—The app. described handles 200 bricks per min.

114. Brick conveyors. Kr. *Tonind. Ztg.*, **44**, 991(1920).—A description of a method of transporting bricks by rail or canal from works to building site. 4 illus.

115. Bog iron ore. Anon. *Deut. Zieg. Ztg.*, **50**, 325(1919).—The ore may be used for making slate-like appearing glazes such as are used on roofing tiles. Analyses are given. A satisfactory mat glaze can be obtained between cones 3*a* and 10. These glazes might be used for face bricks and terra cotta.

116. Improved methods of brick manufacture. A. Bührer. *Tonind. Ztg.*, **44**, 704(1920).

117. Clays for tiles. Anon. *Tonind. Ztg.*, **44**, 1177(1920).—The main requirements are absence of useless impurities, clearness of the fired color and vitrescibility. The vitrification point should not be near a softening point. A satisfactory clay sintered at cone 1*a* to 6 is free from lime, gypsum and pyrites, and is moderately refractory. Thoroughly vitrified ware requires a uniform body.

PATENT

118. Alumina from clay. V. M. Goldschmidt and O. Ravner. U. S. 1,357,089 Oct. 26. Clay or kaolin is calcined at a red heat, lixiviated with HNO_3 to form an Al nitrate soln. and the latter is converted into alumina by calcining or pptn. with NH_4OH. *(C. A.)*

See Abs. 55.

Enamels

119. Anti-corrosive chemical engineering plant. Pumps for corrosive liquids. Anon. Eng. Dept., Guthrie & Co., Accrington, Eng. *Canad. Chem. Met.*, **5**, 341–44(1921); *Engineering*, **110**, 253–54(1920).—Describes centrifugal pumps and other equipment lined with a new ceramic, acid- and heat-resisting coating, called ceratherm, which resembles porcelain. The ceram. lining is cast in the desired form and cemented into place with an acid-proof cement. It is a good heat conductor, resists sudden temp. changes, has high tensile strength and is claimed to be superior to all other ceram. coatings hitherto employed. Ed.

120. **Enameling.** De Dietrich et Cie. Brit. 165,785, June 22, 1921. A current of purified gas is caused to ignite on entering the enameling chamber, and ignition continues in direct contact with the articles to be enameled. In the gas generator one portion of the gas is drawn off and traverses a condenser, which retains the gas tar, oils, and any liquid or solid distn. product, and another portion is obtained by the gasification of undercarbonized coke and washed after deposition in 2 chambers of a very fine cinder. The 2 portions of gas are then reunited in a disintegrator, which also removes the last traces of oil by means of gas tar. The gases pass through a series of safety strainers and, shortly before entering the enameling chambers, combustion commences owing to the introduction of a current of warm air. Combustion is then started and is completed in the enameling chambers. (*C. A.*)

See Abs. 14.

Cement, Lime and Plaster

121. **The slaking of lime when mixed with sand.** W. Drakebusch. *Tonind. Ztg.*, **44**, 1252(1920).—In the manuf. of sand lime bricks, the amt. of sand to be added in the slaking drum process depends upon the amt. of heat generated by the lime during slaking.

122. **Light plaster bricks.** Grossheim. *Tonind. Ztg.*, **44**, 1259(1920).—Good hard-coal ash free from dust and coarse pieces is mixed with water and plaster and poured into moulds.

123. **The Neuss sand lime brick works.** B. Kreiger. *Tonind. Ztg.*, **44**, 862(1920).

124. **Carbide lime as a building material.** Anon. *Tonind Ztg.*, **44**, 1186 (1920).—By-product lime from the acetylene industry is not satisfactory for building purposes.

125. **Utilization of old plaster moulds.** E. Kirchheim. *Tonind. Ztg.*, **44**, 1206(1920).—The author suggests their utilization as a substitute for infusorial earth as a packing mat.

126. **Burning lime with coal with high sulphur content.** Ed. Donath. *Tonind. Ztg.*, **44**, 1260(1920).—The quick lime is contaminated with calcium sulphate.

127. **Impermeable cement pipes.** Anon. *Tonind. Ztg.*, **44**, 878 (1920).

128. **Steam meters for sand-lime brick works.** Anon. *Tonind. Ztg.*, **44**, 641(1920).

129. **Lime and the sand-lime brick industry.** B. Krieger. *Tonind. Ztg.*, **44**, 774(1920).—Production statistics for Germany.

130. **Works management in a cement factory.** O. Schott. *Tonind. Ztg.*, **44**, 438(1920).

131. **The hot method of preparing sand-lime brick bodies.** H. Jolig. *Tonind. Ztg.*, **44**, 953(1920).

132. **Trass and Portland cement.** G. Fredl. *Tonind. Ztg.*, **44**, 1123(1920).

133. **The influence of mortar on wall strength.** Sasse. *Tonind. Ztg.*, **44**, 969(1920).—Results of measurements with diff. mortars.

134. **On the porosity strength and absorbing power of certain calcium sul-**

phate cements. Alice B. Taylor and Edith Irvine. *Trans. Cer. Soc.*, **20**, 83–92(1921).—Porosity and absorbing power decrease and strength increases with wt. of plaster relative to water. Retarders such as borax allow the use of high percentages of plaster in the mixts. and the securing of great strength thereby. The rate of absorption of water by the plasters was found to depend more on the grading of the holes than on the actual porosity. The use of 1% borax in certain plasters gave lower porosity but a higher rate of absorption. H. F. S.

135. Quick hardening cement developed by the French. E. C. Eckel. *Eng. News-Record*, **87**, 566–7(1921).—E. discusses a cement which consists essentially of only lime and alumina, the small amt. of silica present being due to impurities in the raw materials and fuel. A typical analysis is lime 50%, alumina 40%, silica, etc., 10%. The cement is made in a small blast furnace charged with coke, limestone and bauxite; and the temp. is sufficiently high to result in fusion, not merely clinkering. One of its advantages is that it hardens rapidly. Test specimens 24 hrs. old show strengths comparable with 28-day Portland cement specimens. Considering the compn. of this fused cement its most remarkable quality, perhaps, is its resistance to sea water and similar solns., for until cement was introduced it was generally considered that the disintegration of Portland cement in sea water was due to its alumina content. Cements low in alumina were favored for marine construction. A railroad used fused cement on a portion of its line along the Mediterranean where normal cements are badly affected by exposure, but this material shows no effects of exposure to sea water. In lab. tests, cubes made with fused cement have been kept in 3 solns. [(1) sea water, (2) satd. $CaSO_4$ soln., and (3) 1.2% $MgSO_4$ soln.] for 9 years and are still intact. Neat briquets made of fused cement to which gypsum was added in all proportions up to 50% have been kept in water since 1908 without the least signs of disintegration. J. C. Witt (*C. A.*)

136. The action of sulfur on cement in the tropics. A. Bruce. *J. Soc. Chem. Ind.*, **40**, 240T(1921).—Earthenware pipes, laid in Colombo, with cement and a ring of "galanack," and disused for several years showed longitudinal and circumferential cracking. The cement had altered in appearance to that of a white plastic putty and the "galanack" lost its original structure. Analyses of the cement at different ages show increase in SO_4 and loss on ignition, and decreases in lime, iron and alumina and sol. SiO_2. The exact conditions for the change depend more on the manner of application of the galanack, while soil factors are negligible. Galanack is a mixt. of S, tar and oil. W. H. Boynton (*C. A.*)

137. Determination of available lime in quicklime and hydrated lime. Alice I. Whitson. *Chem. Met. Eng.*, **25**, 740(1921).—Work done at the Bur. of Standards shows that the Scaife method is satisfactory for the detn. of available CaO. The procedure recommended is as follows: Place 1.4 g. of the powdered sample in 200 cc. of hot water and boil 3 min. Add phenolphthalein and titrate slowly with *N* HCl until the color is discharged and does not reap-

pear within 2 sec. Repeat the expt. using a liter graduated flask carrying a 1-hole stopper fitted with a short glass tube drawn out to a point. Cool and add, drop by drop, within 5 cc. of the vol. of HCl required in the preliminary expt. Break up any small lumps with a flattened stirring rod, dil. to the mark with freshly boiled water, close the flask, mix well and after settling for 30 min. pipet off 200 cc. and finish the titration with 0.5 *N* HCl. The results obtained in the analysis of 5 samples by different operators show remarkable concordance. W. T. H. (*C. A.*)

138. Waste heat installation at cement plant. Anon. *Rock Products*, **24**, No. 23, 13–17(1921).—An illusd. description of a plant at Dallas, Texas. E. H. (*C. A.*)

139. Lime in 1920. G. F. Loughlin and A. T. Coons. U. S. Geol. Survey, *Mineral Resources of U. S., 1920*, Part II, 178–88(preprint No. 22, published Nov. 3, 1921). E. H. (*C. A.*)

140. A critical review of wet process for manufacture of Portland cement. R. K. Meade. *Concrete* (Mill Sect.), **18**, 135–143(1921); cf. *C. A.*, **15**, 3732.—M. discusses the number of advantages that the wet process of cement manuf. is usually considered to have over the dry process. His conclusion is that the advantages of the dry process are too marked to warrant the substitution of the wet process for it in most instances and that the adherence of the older and more experienced manufacturers to the dry process has been well founded, The possible saving of the wet process in grinding and drying is much more than offset by the saving of the dry process in fuel, while the advantages claimed for the wet process as to lack of dust and better quality of the product are not borne out by either facts or theories. J. C. Witt (*C. A.*)

141. Shrinkage of Portland cement mortars and its importance in stucco construction. J. C. Pearson. *Proc. Am. Concrete Inst.*, **17**, 133–47(1921).—(1) Thin mortar slabs, cast in non-absorptive water-tight forms, may show large and irregular vol. changes in the plastic state, depending chiefly upon the distribution and retention of water in the specimens up to the time of final set. (2) The initial vol. changes under these conditions can, therefore, be reduced and controlled within fairly close limits by taking the necessary precautions. (3) The shrinkage which occurs after the mortars have set persists for many months under ordinary lab. exposure, and is more or less characteristic of the mortar mixts. (4) The use of forms with absorptive bases greatly reduces the initial vol. changes, and has a remarkable effect on the shrinkage which occurs after the mortars have hardened. With dry, or slightly wet bases, the characteristic shrinkage is reduced by 25–50% of the shrinkage of similar mortars in non-absorptive forms, whereas with satd. absorptive bases the shrinkage tends to exceed that of similar mortars in non-absorptive forms. (5) The results of the investigation indicate the very important rôle of absorption or "suction" in actual stucco application, and account for the diversity of condition exhibited by the stucco test panels.

J. C. Witt (*C. A.*)

PATENTS

142. Rotary kiln for sintering cement slurry, etc. A. LARSEN. U. S. 1,358,759; U. S. 1,358,760; U. S. 1,358,761, Nov. 16. (*C. A.*)

143. Cement mixture. E. R. STOWELL. U. S. 1,364,004, Dec. 28. A mixt. adapted for manuf. of light brick or tile is formed of coal ashes 50, Na silicate 12, ground talc 8–10 and Port. cement 5–10 parts. The mixt. may be used as a plaster or floor covering. (*C. A.*)

144. Insulating metallic layers. J. J. ZWERLING. U. S. 1,363,074, Dec. 21. Layers of metal such as parts of elec. heating devices (*e. g.*, irons) are insulated from each other by a coating of Na silicate soln. carrying inert material such as SiO_2 or carborundum in suspension when applied and to which is added, after its placement on the metal, additional inert material such as SiO_2 in granular form. (*C. A.*)

145. Silicate cements. W. CARPMAEL. Brit. 168,659, June 4, 1920. Cements for dental and other purposes consist of a base such as Mg or Be oxide mixed with a soln. of hydrolyzed org. Si compd. contg. a high per cent of silicic acid. The org. Si compd., *e. g.*, tetramethyl silicate or a condensation product thereof, may be hydrolyzed by H_2O or dil. acid, either alone or in the presence of P_2O_5 or an alcoholate of an alk. earth metal or of Mg or of Al or both. Examples of prepns. are given. (*C. A.*)

146. Paints; cements. F. BENSA. Brit. 147,800, July 9, 1920. Pyrite ashes are freed from H_2SO_4, pulverized, freed from H_2SiO_3 and ground with linseed oil to form a rust-preventing cement. A paint is obtained by dilg. the pasty cement with boiled linseed oil. (*C. A.*)

147. Purifying molten slag. J. LUND. U. S. 1,366,398, Jan. 25. Molten slag is purified in order to render it suitable for *cement manuf.* or other uses by applying heat to the under surface of slag, *e. g.*, in a horizontal rotary furnace containing molten Fe, while at the same time treating the upper surface of slag with basic or acid ingredients to adapt it for its particular intended use. (*C. A.*)

148. "Artificial stone." M. JUNGHANDEL. U. S. 1,363,879, Dec. 28. Cement is mixed with an aggregate of elastic capsular material such as calcined rice hulls in order to form a material suitable for building purposes having good insulating properties against heat and sound. (*C. A.*)

149. Coloring cement surfaces. L. A. AND A. J. SANDERS. U. S. 1,364,587, Jan. 4. Surfaces comprizing hydraulic cement and rendered alk. by the presence of lime are colored by treatment with an aq. soln. of a sulfate or other salt or Cu, Fe, Zn, Ni or Pb. (*C. A.*)

150. Hydraulic cement and alkali from natural silicates. E. W. JUNGNER. U. S. 1,357,873, Nov. 2. Liberation and volatilization of alkali on heating a mixt. of lime and feldspar or similar mineral substances is facilitated by adding to the charge about 4% or more of carbonaceous material such as coal, charcoal or sawdust, in finely divided condition. On heating the materials to 1250–1450°, K_2CO_3 is volatilized and a cementitious residue obtained. No Ca salts of inorg. acids are used (except $CaCO_3$ which is converted into lime in the initial stage of heating of the charge). (*C. A.*)

151. Building material from plaster of Paris. M. Baer. U. S. 1,357,375, Nov. 2. A building material especially adapted for use in ship-building is formed of plaster of Paris mixed with chips or particles of wood and metal. (*C. A.*)

152. Cement clinker and by-products. S. B. Newberry. U. S. 1,366,479, Jan. 25. A finely ground mixt. of raw cement materials and carbonaceous fuel is heated by external heat of the gaseous products of combustion of a subsequent stage of calcination of similar material, the condensible products volatilized from the fuel are collected and recovered, and the mixt. is finally calcined by the combustion of the fixed C of the fuel and of gas volatilized from the fuel. (*C. A.*)

153. Cement. S. Matsuo. U. S. 1,367,984, Feb. 8. Hot Port. cement clinker is added to sand which has been washed with HCl while the sand is still wet and the mixt. is cooled and pulverized to obtain a cement which is resistant to brine. (*C. A.*)

154. Recovering potassium compounds in cement manufacture. C. Catlett. U. S. 1,354,727, Oct. 5. Recovery of K. compds. in treating a Portland cement mixt. (which may contain feldspar to increase the K content) is facilitated by the addition to the mixt. of 1–5% of a set Ca oxychloride compn. of the sorel cement type. Sufficient of the latter is used to supply Cl to combine with the K to be recovered. The volatilized K values leaving the kiln with the dust may be recovered by simple subsidence, use of wet or dry filters or by elec. pptn. The recovered material may be used as a fertilizer directly or may be leached for the recovery of K compds. in crystd. form. The use of Ca oxychloride is stated to have the advantage over NaCl that the fume and gases produced are much more readily recovered by elec. pptn. and no detrimental effect on the cement clinker is produced. Oxychlorides of Mg and Zn also may be used. The various oxychlorides (including a product formed by treating bittern with $Ca(OH)_2$) may also be used for treating feldspar to produce sol. K compds., with or without simultaneous use or $CaCO_3$, $CaSO_4$ or other auxiliary substances. (*C. A.*)

155. Plastic coating material containing cement. J. C. Dobbins. U. S. 1,355,131, Oct. 12. A coating material in paste form, adapted for use on walls or fabrics, is formed of Portland cement 100, hydrated lime 13, a coloring material and mica 1.3 parts, H_2O and Na silicate soln. (*C. A.*)

156. Asbestos cement building material. R. V. Mattison, Jr. U. S. 1,355,406, Oct. 12. An asbestos cement suitable for building bricks, roofing or flue linings is formed of Portland cement and finely ground serpentine. The serpentine used contains microscopic fibers of asbestos and a considerable propn. of ground quartz. (*C. A.*)

157. Building block. F. J. Kramer. U. S. 1,363,045, Dec. 21. A mixt. for making building blocks is formed of pulverized furnace slag 79.8, cement 20, $KMnO_4$ 0.175 and HF 0.025% mixed with H_2O. The $KMnO_4$ facilitates hardening and the HF prevents discoloration. (*C. A.*)

See Abs. 110.

ACTIVITIES OF THE SOCIETY

Minutes of the Meetings of the Board of Trustees

February 27th to March 2nd, 1922

Report of the Committee on Publications:

Voted to accept the recommendation that the *Journal* be increased from eighty-five to one hundred pages per month.

Voted to exchange the *Journal* for other periodicals of equal value, and to subscribe for those of less value, when needed by the editor.

Voted that instructions to contributors to the *Journal* be compiled and distributed.

Voted that fund for expenses of a booth at the Chemical Exposition be omitted from the budget

Voted that the policy of not paying expenses of officers of divisions to meetings, unless specifically delegated by the President, be confirmed.

Voted to request a report from the Committee on Publications and one from the Secretary on the feasibility of soliciting advertising from the Secretary's office.

Voted that the editorial work of the *Journal* be transferred to the office of the Secretary, the Secretary to be Editor for the present year.

Voted to confirm the Board of Associate Editors as appointed.

Voted that the question of handling the *Journal* and the *Bulletin* be referred to the Committee on Publications and the Editor, with power to make definite decision.

Voted to accept resignation of Mr. F. H. Riddle as Trustee.

Voted to appoint Mr. F. B. Ortman as Trustee, to serve the unexpired term of Mr. Riddle.

Voted that list of nominations for active membership be submitted to Board for a vote by mail.

Voted to hold the 1923 annual meeting of the Society in Pittsburgh.

Voted to hold the 1922 summer meeting in Montreal and vicinity.

Voted that on request for loan of cuts used in the *Journal*, electro plates be made at the expense of those requesting, with the understanding that all possible assistance in reprinting articles should be given.

Voted that reprints of the report of the Committee on Standards be made, to be supplied at a rate to be fixed, leaving the distribution of free copies to the discretion of the Secretary.

Voted to continue the contribution of $50 in support of the publication of the Annual Tables of Constants.

Voted to refer the revision of the price of complete sets of the Transactions to the Committee on Publications.

Voted that the Committee on Publications take up the matter of papers in the *New Jersey Ceramist*, with the Committee on Publications thereof.

Voted to accept the report of the Committee on Budget as follows:

ESTIMATED INCOME

Membership			
Individual (1700)		$12,750	
Corporation (250)		6,250	
Subscriptions		1,500	
Advertising		17,700	
Volumes, Sale		1,200	
Seger and Index		80	
Interest		400	$39,880

ESTIMATED EXPENSE

Publication			
Printing	$15,000		
Abstracts	400		
Reprints	600		
Salaries	1,500		
Office Expense	500		
Year Book	575	18,575	
Advertising Commission		4,185	
Secretary's Office			
Salaries	7,820		
Clerical Help	1,000		
Bulletin	——		
Traveling	1,800		
Office Expense	2,000	12,620	
Divisions		700	
Committees		400	
Meetings		1,500	
Miscellaneous		900	
Shrinkage		1,000	$39,880

Report of Committee on Budget

The receipts are based upon an estimated increase in membership of 100 Corporation and 180 Associate members.

In the opinion of the Committee the estimated expenses for publication can be materially reduced by changing the shape of the *Journal* and the size of type used. This is suggested to the Committee on Publication for their consideration.

The present expense of securing advertising can be lowered by having our own organization solicit the same.

(Signed) F. H. Riddle, *Chairman*,
Ross C. Purdy,
R. K. Hursh.

Voted to confirm the appointment of representatives on committees of the A. S. T. M. as follows:

Proposed Representative on A.S.T.M. Committees

A-1 on Steel, Sub-Committee XIX on Steel Sheets—R. R. Danielson
C-1 on Cement—Robert W. Jones
C-3 on Brick—Roy A. Horning
C-4 on Clay & Cement Sewer Pipe—Fred L. Dickey
C-5 on Fireproofing—Geo. A. Loomis
C-6 on Drain Tile—J. L. Childs
C-7 on Lime—A. A. Silverman
C-8 on Refractories—Wm. E. Dornbach
C-10 on Hollow Building Tile—C. F. Tefft
C-11 on Gypsum—Geo. A. Bole
D-11 on Electrical Insulating Materials—Walter Hull
D-10 on Shipping Containers—E. Ward Tillotson
D-14 on Screen Wire Cloth—W. D. Richardson

Voted to confirm appointment of the standing committees as follows:

Proposed Standing Committees for 1922

Committee on Research:
Dr. Wm. M. Clark, *Chairman*
E. W. Washburn
Paul E. Cox
Albert V. Bleininger
and one from each division

Committee on Standards:
Walter E. Hull, Chairman
(*a*) Definitions: A. S. Watts
M. F. Beecher
A. F. Greaves-Walker
(*b*) Raw Materials: D. W. Ross
M. C. Booze
E. C. Hill
(*c*) Standardization of Tests:
All appointed by Divisions
(*d*) Standardization of Products:
All appointed by Divisions

Committee on Geological Surveys:
T. Poole Maynard, *Chairman*
Robert W. Jones
H. Ries

Joseph Keele
Hewitt Wilson

Committee on Data:
To be appointed by Divisions

Committee on Ceramic Education:
Not yet provided for by Constitution

Committee on Rules:
T. A. Kleinfelter, *Chairman*
R. L. Clare
A. S. Walden
B. T. Sweely
J. L. Crawford
and Chairmen of Committees on Rules in Divisions

Committee on Publications:
R. H. Minton
E. Ward Tillotson
Chester H. Jones
H. F. Staley
R. C. Purdy

Committee on Papers and Program:
R. D. Landrum
and Secretaries of Divisions

Committee on Membership:
E. P. Poste, *Chairman*
O. O. Bowman, 2nd
Charles Sebring
D. F. Stevens
Frederick Stanger
and Chairmen of Committees on Membership in Divisions

Committee on Sections and Divisions:
J. B. Shaw, *Chairman*
Robert Back
Wm. E. Dornbach
Geo. P. Fackt
Major E. Gates
and Chairmen of Divisions

Voted to recommend to the Committee on Rules that the Constitution and By-laws be amended, to the effect that no paid officer or employee of the Society shall have a vote upon any committee to which he is appointed by virtue of his position.

Voted to interpret literally the article in the Constitution which states that all publications of the Society come under the general supervision of the Committee on Publications.

CERAMIC ABSTRACTS

Compiled by the

AMERICAN CERAMIC SOCIETY

Ross C. Purdy, Editor
Emily C. Van Schoick, Ass't Editor

Abstractors: E. N. Bunting, W. M. Clark, L. H. Cole, G. S. Fulcher, S. L. Galpin, Seiji Kondo, A. T. Malm, R. J. Montgomery, Louis Navias, C. W. Parmelee, C. M. Saeger, Jr., H. G. Schurecht, R. B. Sosman, H. F. Staley, E. W. Tillotson.

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General and Miscellaneous

1. **Failure of a mortared smoke stack.** Vn. *Rev. Mat. Constr. Trav. Pub.*, **147**, 225(1921).—A 54-meter smoke stack attached to a rotary cement kiln which had been standing idle for 10 months, was found to be listing 50 cms. at the top, leaning in the direction from which heavy winds were always blowing. The leaning started 14 meters from the top rim. Analyses of the mortar taken from the inclined portion showed the presence of 1–1.5% of SO_3 in the half against the wind while the opposite half had 7–12% SO_3. It is conjectured that the far side of the rim became soaked by the driving rain and that the wetting then continued on that side downwards. Sulphur from fuel that was deposited on the chimney lining combined with the lime of the mortar forming gypsum mostly on the side further away from the wind. The swelling of the plaster caused the stack to list. A similar case in Sweden is also cited. Louis Navias

2. **Belt, gear and chain drives for grinding mills.** George J. Young. *Eng. Min. J.*, **112**, 969–71(1921).—Describes installations and discusses merits and faults of these drives as used in ore grinding. S. L. Galpin

3. **Importance of the mineral industries.** Editorial. *Eng. Min. J.*, **112**, 681(1921).—During quarter ending June 30, 1921, railroads of U. S., hauled 222,000,000 tons freight. Coal and coke 89,000,000; stone, clay, gravel, sand 23,000,000, iron ore 9,000,000,000, crude petroleum 1,000,000; agricultural products 21,000,000; animals and animal prod. 6,000,000; forest prod. 20,000,000; manufactured prod. and misc. 42,000,000. S. L. G.

4. **The Bureau of Mines and Private Investigations.** H. Foster Bain. *Eng. Min. J.*, **112**, 450–3(1921).—Details conditions under which the Bureau may coöperate with industries and individuals for research and investigations. S. L. G.

5. **Preparation of Fuller's Earth in Florida.** Strauss L. Lloyd. *Eng. Min. J.*, **112**, 860.—Fuller's earth is found in 6′ to 20′ strata of Upper Oligocene age in Gadsden Co. (North Fla.) and Manater Co. (South Fla.). 12′–14′ overburden is stripped and usually only upper half of earth bed is removed. Raw material is crushed, dried, bolted and bagged. For clarifying petroleum products 15–30, 30–60, and 60–80 mesh sizes are sought. For vegetable oils finer material may be used but very fine condition is undesirable. Ark., Colorado, Calif., Ga., and Mass., are also producing states. S. L. G.

6. **Large production of Fuller's Earth in 1920.** *Eng. Min. J.*, **112**, 410.—Figures taken from *Min. Res.*, **1920**, U. S. Geol. Survey. S. L. G.

7. Incinerator for mill refuse made of brick and concrete. H. Ludwig. *J. Elec. Western Ind.*, **47**, 473(1921).—The incinerator consists of a concrete shell with fire brick lining 14 ft. in diam. at the base and 60 ft. high. The feed pipe is 18 in. in diam. and as much as 400 cu. yds. of refuse can be consumed per 9 hrs. Full details of construction are given. The temp. of the combustion chamber ranges between 800° and 1100°. C. G. F. (*C. A.*)

8. Review of the most important German patents on flotation with special reference to the patents of Mineral Separation, Ltd. J. Friedmann. *Metall u. Erz*, **18**, 431–37 (1921). R. S. Dean (*C. A.*)

9. Insulating materials. S. Halen. *Kunststoffe*, **11**, 137–9(1921).—Review of German patents. C. J. West (*C. A.*)

10. The preparation, transportation and combustion of powdered coal. J. Blizard. Can. Dept. Mines, Mines Branch, *Bull.* **564**, 131 pp.(1921).—This is an extensive treatise, with 39 figures of machinery and plant, and many quotations from recent literature. The subjects treated are: suitable coals; drying and pulverizing; storage and distribution; mixers and burners; use for steam-raising; other uses; cost of plant and of prepn.; safety. The material is mostly compiled; but some results of boiler tests are given. Powd. coal shows a high efficiency in use, due to the very low combustible in the ash and the high CO_2 content of the flue gas. The cost of prepn. and delivery to the furnace is said to be from 50 cents to $3.00 per ton. Ernest W. Thiele (*C. A.*)

11. Complete gasification of coal. A. W. Warner. *Proc. Am. Gas Assoc.* (1921 Convention), Sep. 36 pp. bibliography.—W. reviews the method of complete gasification in 1 machine but in 2 or more chambers as found in Smith's adaptation of Kramer and Aart's double gas plant, and the Tenney process which utilizes bituminous coal for production of carburetor water gas; the method for partial gasification in one machine and chamber as exemplified in steaming of continuous vertical retorts (Beilby, *C. A.*, **15**, 2711); and complete gasification in 2 stages, as found in coal carbonizing plants with blue gas plant or carbureted water gas plant using the surplus coke. With the latter method applied to intermittent verticals at Rochester making coal gas and blue gas, the cost per therm. for the first stage for 8 months of 1921 including fixed charges, based on the price of coal, of 14 cents per M. cu. ft., was 8 cents, while for the 2nd stage with fixed charges of 2.75 cents was 9.2 cents. Since gaseous B. t. u.'s are sold with more profit than B. t. u.'s in form of coke, it looks as if our future choice would lie between rich coal gas dild. with blue water gas and balance of coke completely gasified and the gas enriched with oil. J. L. Wiley (*C. A.*)

12. Boiler plant efficiency. V. J. Azbe. *Mech. Eng.*, **43**, 722–4, 726(1921).—The object is to show to what extent boiler-plant wastes are preventable or can be made to balance each other, and to recommend a standard for boiler operation toward which designers and operators may aim. The usual wastes in boiler plants are emphasized by means of tables and curves of boiler performance. 90% efficiency is attainable under favorable conditions, this 90% representing boiler and economizer only. The requirements are severe and with 12,000 B. t. u. coal, 15% excess air would have to be used, flue-gas temp. would have to be no more than 250°F, combustion complete and no C in the ash. The requirements of the ideal boiler installation of today are summarized. J. L. Wiley (*C. A.*)

13. Fuel saving in modern gas producers and industrial furnaces. W. B. Chapman. *Mech. Eng.*, **43**, 717–21(1921).—There are 10,000 gas producers in the U. S. Progress made in the past 25 yrs. in gas-producer construction is shown in descriptions of some of the leading types. Any of these with skilled handling can make a gas averaging 160–175 B. t. u., provided the coal is of fair quality and the rate of gasification does not exceed 25 or 30 lb. per sq. ft. per hr., and with a saving of about 25% in coal and in

labor. A further saving in coal can be brought about by using suitable accessories in the gas house, such as pressure regulators, and a temp. recorder. Besides conserving fuel by proper gasification, further economy can be effected by its proper utilization in the furnace. The recuperative furnace holds the greatest promise in this direction, as its field of application is very broad, it being capable of effective use in both large and small operations and for furnace temps., as high as 2700 and as low as 1400°. From 20 to 40% of the fuel can be saved by using a recuperative furnace, such as the Stein, which preheats the air to within 500°F of the furnace temp. The extension of the use of such a furnace to pulverized coal and oil would also result in similar savings. Also in *Iron Age*, **108**, 1671–2(1921). J. L. Wiley (*C. A.*)

14. Determination of the carbon-dioxide content of flue gases from the firing of steam boilers. H. Winkelmann. *Braunkohle*, **20**, 307–10, 326–9(1921).—After dealing with the important theoretical principles of combustion, the various methods for detg. CO_2 in flue gases are described. An extensive illustrated description is given of the automatic recording app. manufd. by Ados, Ltd. of Aachen. C. C. Davis (*C. A.*).

15. Determination of the carbon-monoxide and carbon-dioxide contents of producer gas. H. Winkelmann. *Wärme u. Kalte-Tech.*, **23**, 229–30(1921).—The gas is first passed through a filter and then through an automatic CO_2 recorder driven by an elec. motor where the CO_2 content up to 20% is recorded. It then passes to a CO filter filled with a colorless powder which completely absorbs the CO_2. This powder becomes red on absorbing CO_2 and remains so until its efficiency is exhausted when it loses its red tint; it should last 1–2 weeks. The gas, which then contains only CO and hydrocarbon, passes into an electrically heated combustion oven containing an oxidation material and is oxidized to CO_2 which is analyzed and recorded in the usual known manner. About 30 such analyses per hr. can be carried out. J. L. Wiley (*C. A.*)

16. Gas manufacture and tar recovery with special attention to carbonization of lignites. Konrad Arnemann. *Gas u. Wasserfach*, **64**, 665–73(1921).—Details are given of construction and operation of plant for gasification of lignite, both in raw form and in briquets. Some data are given in relation to costs, raw material, finished products, and yields. J. L. Wiley (*C. A.*)

17. Modern Pintsch-generator gas plant and results of operation with different fuels. H. Lichte. *Gas u. Wasserfach*, **64**, 635–9, 651–8(1921); 24 figs.—Detailed descriptions are given of the following types of generators built by the Julius Pintsch Co., and their operation together with results of operation: (1) Normal generators with rotary grates, round grates, flat grates, step grates and tap generators; (2) generators for production of tar-free gas with double combustion space or with tar burning, and (3) generators with low-temp. tar recovery. J. L. Wiley (*C. A.*)

18. Smokeless fuel. W. Strafford. *Gas J.*, **156**, 806–7(1921).—An exptl. plant has been working successfully for some time on the production of *Fuelite* from refuse coal materials. A smokeless domestic fuel is made as well as good coke of any degree of quality. The refuse is first ground to 1/4-in. size, mixed with crude tar, pressed into open trays about 18 by 7 in. in size coupled together and then passed slowly through the retort, consisting of a 9-in. steel pipe 50 ft. long and heated by crude tar burned in a special type of tar burner (described with diag.). The success of the plant is largely due to this appliance. From 24 tons of refuse, mixed with tar, 25 tons of Fuelite were produced, having a calorific value of 13,556 B. t. u. per lb.; that made from coke dust 12,952 B. t. u. per lb. J. L. Wiley (*C. A.*)

19. Engineers and chemists. The coöperation of the engineer and chemist in the control of plants and processes. G. M. Gill. *Engineering*, **113**, 57–9(1922). E. J. C. (*C. A.*)

20. Smokeless fuel for domestic purposes. ANON. *Electrician*, **87**, 579(1921).—A brief account of a new continuous oven process. Twenty ovens produce 30 tons of coke per day. They are of the upright type, divided longitudinally into 3 compartments by 2 perforated Fe plates. The retorts are gas-heated. One ton of an av. small slack coal will produce 14 cwt. smokeless fuel, 16 to 18 gals. of tar oil, 6000 cu. ft. of gas, 14 lbs. $(NH_4)SO_4$, 2 to 3 gals. of motor spirit. The coal used in the low-temp. process is generally 2 parts non-coking to one part coking. C. G. F. (*C. A.*)

21. The control of combustion in furnaces. F. MARTIN. *Age de fer*, **37**, 905–8, 992–3(1921).—M. calls attention to the use of a recording differentiation pressure gage between ash bed and firebox for controlling combustion in furnaces.

A. PAPINEAU-COUTURE (*C. A.*)

22. Critical investigation on jig sieves, especially those of Schubert (D. R. P. **235**, 520) **and Schuchard** (D. R. P. **241**, 779). W. GROSS AND W. GOY. *Metall u. Erz*, **18**, 121–26, 152–58, 177–84(1921).—For upper Silesian Zn and Pb ores the grate screen of Schubert is especially good, followed by the Schuchard corrugated screen and the conically perforated sheet. The quality and accuracy of the sepn. depends on the relation of the free openings to the pressure. The force needed is inversely proportional to the free openings. For *coal washing* there is little difference in screens. R. S. DEAN (*C. A.*)

23. Theory of the water-gas process. S. KOHN. *J. Ind. Eng. Chem.*, **14**, 69–72 (1922).—K. discusses the 10 possible and 3 probable combinations of reactions which can be used to explain the water gas process. Demonstration is made of a possibility of drawing conclusions from the compn. of the resulting gases to the actual procedure of the reactions. The applicability of the principles outlined is tested on a series of 9 observations published by Bunte and Harries (cf. Haber, Thermodynamik technischer Gasreaktionen), and their application to catalytic observations is discussed.

J. L. W. (*C. A.*)

PATENTS

24. Supplying steam to gas producers. H. F. SMITH. U. S. 1,397,554, Nov. 22 Steam supply to gas producers is regulated by an automatic valve control system depending upon the sp. gr. of the gas produced. U. S. 1,397,555 relates to similar automatic steam supply regulation depending upon the moisture content of the gas produced. (*C. A.*)

25. Burning liquid fuel in jets. W. N. BEST. U. S. 1,397,791, Nov. 22. A flat fan-shaped spray of liquid fuel such as oil or tar is delivered to a burner by a vaporizing jet of steam or air and burned together with finely divided coal in a flat fan-shaped flame for heating furnaces or oxidizing Cu or other materials. U. S. 1,397,792 relates to an app. for burning liquid and solid fuels together in this manner. (*C. A.*)

26. Clay mixture for earthenware manufacture. C. E. FULTON. U. S. 1,398,014, Nov. 22. A mixt. of good plasticity with a low H_2O content is formed of clay 100, gallic acid 0.02, Na silicate 0.0224 parts, with or without NaOH 0.02 part or a small amt. of other alk. hydroxide. (*C. A.*)

27. How heat losses in chemical plants may be reduced. JOHN PRIMROSE. *Chem. Age* (N. Y.), **29**, 449–50(1921).—A plea for greater attention to proper boiler settings, firing, use of economizers, preheaters, insulation, etc., in order to save fuel. Superheated steam for power generation and for high temp. process work, combination of processes so as to utilize steam as in a step-down transformer, satd. steam for temps. up to 300°F, and oil or other fluid heat transference, are discussed briefly.

W. C. EBAUGH (*C. A.*)

28. Furnace for enameling ceramic or other ware. R. ROADHOUSE. U. S. 1,395,732, Nov. 1. The furnace is adapted to be heated by oil burners. (*C. A.*)

29. Clay-working machinery. WALTER A. GRURNBERG. U. S. 1,394,495, Oct. 18,

1921. In a clay-working machine, a base, a rotatable top thereon, molds on the top, means for rotating the top a quarter of a turn at a time, means for opening and closing the molds, and means for brushing out the molds, means for inserting clay into the molds, means for coring out the molded clay, and means for opening the molds to deliver the molded product at each successive turn of the machine top. C. M. S., Jr.

30. **Phosphate-rock-calcining process.** Mark Shoeld. U. S. 1,393,839, Oct. 18, 1921. The process of calcining phosphate rock consisting in suddenly heating the material to be treated to the reaction temperature in form approx. from one to 5 seconds to prevent any substantial preliminary detrimental heat action on the material.

C. M. S., Jr.

Apparatus and Instruments

31. **A new optical pyrometer for high temperatures.** G. Keinath. *Elektrotechn. Z.*, **42**, 1384–6(1921).—A detailed description of the new "ardometer" of the Siemens-Halske Co. It is a total radiation pyrometer, a modification of the Thwing pyrometer. The thermoelement consists of a small piece of Pt foil, 0.007 mm. thick to which the 2 leads, 0.03 mm. in diam., are hard-soldered. On account of the fineness of these wires the element responds and reaches equil. within 10 sec. The element is sealed into an evacuated glass bulb. At 1400° a reading of 15 mv. is obtained. The ardometer is therefore 4 times as sensitive as the Fèry pyrometer. The minimum temp. accurately read is 600°. Numerous applications are described. C. G. F. (*C. A.*)

32. **Apparatus for the determination of moisture.** F. W. Shulenberger. *Paint, Oil and Chem. Rev.*, **72**, No. 25, 8, 14–5(1921).—S. describes an automatically controlled elec. oven with a revolving shelf on which the samples for test are placed. The method for detg. moisture and sediment in oils given in *Bur. of Mines Bull*, No. 5 and the modified method as improved by Dean and Stark are given in detail.

Donald E. Sharp (*C. A.*)

33. **Automatic recording and analytical apparatus.** L. Levy. *Chem. Age* (London), **5**, 652–5(1921).—A brief description of recording thermometers and pressure gages, sp.-gr. recorders for gases and liquids, recording calorimeters, total quantity meters, and CO_2 recorders. Simmance's sp.-gr. recorder for gases is more fully described than the others. Donald E. Sharp (*C. A.*)

34. **The differences in the measurements obtained on adiabatic and ordinary calorimeters.** W. Swientoslawski and Milles. H. and Z. Blaszkowskie. *Roczniki Chemji*, **1**, 166–70(1921).—Comparative measurements were made on 2 calorimeters, adiabatic and ordinary, under various conditions. The measurements on the adiabatic calorimeter were made when t_o = const., t_n = const., and under adiabatic conditions. Those on the ordinary calorimeter were made both with and without precautions against the evapn. of the water. The results obtained indicated that identical values could only be obtained under adiabatic and isothermic conditions where t_o = const. In all other cases considerable ($\pm$ 0.03% to $\pm$ 0.46%) differences were observed.

J. M. K. (*C. A.*)

35. **New alternating current electric furnace installation in Dept. of Electrochemistry, Univ. of Toronto.** A. E. R. Westman. *Can. Chem. Met.*, **5**, 224–5(1921).—This dept. has a 200 kilovolt-amp. installation, supplied at 2200 v. 25 cycles, single-phase. Of special interest in the transformer room, are line fuses of 100 amp. 7500 v. limit of the "Sand C" type, CCl_4 being automatically projected into the fuse chamber when fuse melts to prevent arcing. Full elec. details are given. F. H. Hotchkiss(*C. A.*)

36. **Recording calorimeters.** J. W. Cobb, J. W. Wood, *et. al.* *Gas J.*, **156**, 197–201, 740–1(1921).—Discussion of and reply to a report on the Simmance calorimeter (*C. A.*, **15**, 3195). J. L. Wiley (*C. A.*)

37. Recording combustible gases. R. Moeller. *Gas Age-Record*, **48**, 904–7 (1921).—Description and operation of *Mono* equipment for use in boiler, water gas, coal gas and coke oven plants are given. Sample recording charts are shown.
J. L. Wiley (*C. A.*)

38. Temperature measurements in melting and annealing furnaces in the alloy industry. F. Hoffmann. *Metall u. Erz*, **18**, 489–95(1921).—Temp. measurements on melting furnaces are in general without value as well as impracticable to be made. For annealing furnace recording thermocouples are practical and valuable, provided they are properly placed. R. S. Dean (*C. A.*)

39. Coal saving in gas works. Anon. *Gas World*, **75**, 430(1921).—The use of the *W. R. CO_2 Indicator* is discussed. (Cf. Ringrose, *These Abs.*, **1**, 4(1922).)
J. L. Wiley (*C. A.*)

PATENTS

40. Apparatus for effecting circulation and maintaining clean surfaces in stills. A. D. Smith. U. S. P. 1,403,980, 17.1.22. Appl., 13.9.19. Means are provided for circulating the liquid longitudinally, and for sweeping the bottom portion of the still crosswise, the sweeping device being caused to oscillate backwards and forwards in the liquid space of the still. A. R. M. (*J. Chem. Ind.*)

41. Boiler applicable for use as absorber in absorption refrigerating machines. W. Pfleiderer. G. P. 343,938, 4.4.15. Two vessels are disposed one above the other, and liquid is forced from the lower into the upper, so that only very little can remain in the lower vessel below the bottom of the tube connecting the two. Loss of liquid due to evapn. of liquid constantly draining from the upper to the lower vessel is thereby compensated. The rate of gas production is appreciably increased, and absorption of gas effected more rapidly, as the gas returning from the lower vessel passes through the absorbing fluid therein and in the upper vessel, in the form of bubbles.
J. S. G. T. (*J. Chem. Ind.*)

42. Electric furnace. W. Lohrey. U. S. 1,396,374, Nov. 8. The furnace comprises a mixing crucible within which metals such as Zn, Al, or Cu and Mg supplied from other crucibles within the furnace may be combined. (*C. A.*)

43. Electric rotating furnace. C. E. Cornelius. U. S. 1,396,677, Nov. 8. The furnace is adapted for melting powdered metallic substances such as Zn which are continuously introduced. (*C. A.*)

44. Die for making articles of plastic material. Andrew W. Gates. U. S. 1,393,014, Oct. 11, 1921. A mold for forming earthenware articles, comprising outer and inner die members shaped to form articles having cylindrical and conical portions and means for rotating one of the members and forcing it longitudinally with respect to the other member. C. M. S., Jr.

Chemistry, Physics and Geology

45. What happens under a pressure of 300,000 lb. per sq. in. Anon. *Eng. Min. J.*, **112**, 14.—Extracts from P. W. Bridgman's report in "Compressed Air." S. L. G.

46. The Euboean magnesite field. Harry C. Boydell. *Eng. Min. J.*, **112**, 771–3.—These deposits lie about 120 km. north from Athens, in serpentine in Cretacic limestones. Magnesite occurs as replacements along fault and joint fissures, in irregular lenses up to 130 ft. wide and 1800 ft. long, and of undetermined depth. The magnesite is dense cryptocrystalline and usually white. Some deposits are calcareous but the shipping ore is guaranteed 94% $MgCO_3$. Much of the product averages higher. Miners (native) receive 65–70 cts. per day. Ore is hand-picked by women. Part is shipped raw, part, "caustic burned" (to 800°C), part, "dead burned" (to 1500°C). Greek, British and Dutch interests operate mines and furnaces. The product is all exported. S. L. G.

47. The Callville Wash colemanite deposit. Hoyt S. Gale. *Eng. Min. J.*, **112**, 524–30.—A new deposit found in Jan., 1921, in S. E. Nevada (Clark Co.). Deposit seems to be of thermal spring origin and is in the nature of a large lens, in Tertiary rocks. Estimated 400,000 tons crude colemanite averaging 20% B_2O_3 or better. S. L. G.

48. Converting dolomite into magnesite. Djevad Eyoub. *Eng. Min. J.*, **112**, 771–6.—*Experimental.* Dolomites low in silica were calcined and leached. ($Ca(OH)_2$ said to be about 15 times as soluble in H_2O as Mg $(OH)_2$.) From 950° to 1000°F. (C ? abs.) found to be best temperature for calcination. Residue after leaching found in several cases, to compare very favorably with market material. S. L. G.

49. Non-metallics and enameled ware—"Consultation." *Eng. Min. J.*, **112**, 936.—Mentions minerals used in enameling iron, and gives ingredients for one ground, and one finishing coat. S. L. G.

50. Bentonite, its production and uses—"Consultation." *Eng. Min. J.*, **112**, 819.—Condensed statement based on Ladoo's pamphlet (U. S. Bureau Mines). S. L. G.

51. Manifold uses of quartz—"Consultation." *Eng. Min. J.*, **112**, 101. Summarized statement prepared from *Min. Res.* of U. S. Geol. Survey. S. L. G.

52. Geology of the Isle of Wight. H. J. Osborne White. *Memoirs of the Geological Survey, England and Wales*, **1921**, 201–202.—Gives a brief review of source of brick and tile material to be found on this island. L. H. Cole

53. Mineral production of India 1914–1918. H. H. Hayden and Others. *Geological Survey of India*, **LII**, 1921.—This report gives resumés of the mineral production of India. Among the materials mentioned of interest to the ceramic industry are clays, cobalt, chromite, graphite, bauxite, borax and monazite. L. H. Cole

54. Economic minerals of Idar State, India. C. S. Middlemiss. *Geol. Surv. India*, XLIV, **1**, 145–50(1921).—The writer in summing up economic possibilities of this State, mentions the occurrence of ordinary brick clays as well as the kaolin of Eklara and other places which may be of future value. Among other minerals of interest referred to are asbestos, chromite, magnesite, dolomite, talc and steatite. L. H. Cole

55. Graphite—Recent developments in the Buckingham District, Que., Canada. V. L. Eardley-Wilmot. *Bull. Can. Inst. of Mining and Met.*, **1921**, 539–555.—This paper gives a brief review of the occurrence and origin of graphite in Canada, as well as a thorough discussion of the mining and milling methods in present practice. Graphite products and uses are dealt with at length, the more important ones being crucible flake, lubricating uses, stove polish, foundry facings, etc. A description is given of the mill of the Quebec Graphite Co., at Buckingham, Que. L. H. Cole

56. A note on colloidal selenium. A. Gutbier and R. Emslander. *Ber.*, **54B**, 1974–8(1921).—It was noticed that the presence of electrolytes had an important influence on the coagulation of colloidal Se by freezing. Since the solns. used contained H_2SeO_3 a way was sought to *prepare colloidal Se entirely free from electrolytes.* This was done by pouring hydrazine hydrate over SeO_2. The reaction is vigorous, sometimes producing flame. The mixt. should be cooled to prevent loss by evapn. When the SeO_2 settles out a blue-red soln. remains. Diffusion expts. with gelatin gel show it to be a true mol. soln. When put into much water it becomes a red colloidal suspension. Hydrazine hydrate also dissolves the gray Se at ordinary temp. A gas contg. H_2, N_2 and NH_3 is evolved, and a soln. which changes in color from brown to deep red forms. It also produces colloidal Se when put in a large excess of water. When dil., these colloids are stable for a week, become streaked on standing but uniform again on stirring. They endure boiling and can be freed from nearly all of the N_2H_4 in a Graham dialyzer or by means of parchment paper. $BaSO_4$ ppts. the colloidal Se completely. The stability of the colloid is a function of the degree of dispersion as is shown by the fact that a sample was completely coagulated in 3 days while all weaker concns. required

longer time for pptn. The original colors of the colloids indicated that the more dil. the Se the higher was the dispersion. To test the effect of electrolytes at ordinary temps. 0.0845 g. of gray Se in 1 cc. of hydrazine hydrate was poured into 1 l. of water and dialyzed for 6 days. Solns. of electrolytes 2 *N* in concn. added to equal vols. of this colloid, acted as shown below. On the addn. of HCl, HNO_3, H_2SO_4, H_2SeO_3 and CH_3CO_2H, the yellow colloid became successively red, violet and blue. This indicates a growth in the size of particles. NH_3 had no effect. NaOH made the color brighter and $Ba(OH)_2$ completely pptd. it. When frozen, coagulation was complete and irreversible. The addition of such substances as HCl up to 0.003 *N*, Na_2CO_3 up to 0.013–0.052*N* and KCl up to 0.05 *N*, stabilized the colloid when there was 0.110 g. of Se per 1. and prevented coagulation by freezing. Higher concns. of these salts are efficient coagulants of the same colloid. F. E. Brown (*C. A.*)

57. Organogels of silicic acid. B. S. Neuhausen and W. A. Patrick. *J. Am. Chem. Soc.*, **43**, 1844–6(1921).—Graham's statement that one liquid will entirely replace another in silica gels is not entirely true. Silica hydrogels retain as much as 4.8% of water when heated to 300° in vacuum for 6 hrs. Soaking in other liquids does not remove the last small portion of water. High temps. drive out the last traces of water without affecting the structure of the gel appreciably. The last portion of water is held by a force greater than that between the atoms of many stable compds.
F. E. B. (*C. A.*)

58. Heat of wetting of silica gel. W. A. Patrick and F. V. Grimm. *J. Am. Chem. Soc.*, **43**, 2144–50(1921).—Careful measurements of the heat of wetting of silica gels were made in an adiabatic calorimeter at 25°. The averages of the observed values in cals. per g. were, for water, 19.22; for C_2H_5OH, 22.63; for C_6H_6, 11.13; for CCl_4, 8.42; for $C_6H_5NH_2$, 17.54. It was detd. that the heat of wetting between 0° and 4° was positive. If the d. of silica gel is assumed to be 2 and the particles 5 $\mu\mu$ in diam. these heat effects could be explained by surface energy. F. E. Brown (*C. A.*)

59. Water of Borax Lake. Roger C. Wells. *J. Wash. Acad. Sci.*, **11**, 477–81 (1921).—Analyses in 1863, 1887 and 1921 indicated that the proportions of the salts present have changed since 1863. "In order to represent the dissolved alk. matter in the form of the customary buffer salts, as has been done for Searles brine, an artificial water, contg. 18.5 g. NaCl, 0.5 $MgCl_2$, 1.0 KCl, and 0.03 $CaSO_4$ per l., was made up as a medium to which buffer salts could be added and resulting *pH* values detd. A set of *pH* detns. was then made with various proportions of Na_2CO_3 and $NaHCO_3$; the total CO_2 was kept equal to that found in the lake water. Another similar set was made with mixts. of borax and $Na_2B_2O_4$; the total B_2O_3 was kept the same as found in the lake water." The results are tabulated and shown by curves. The *pH* value of the water was 9.75. To yield this figure the salts should be distributed in g. per l. as follows: Na_2CO_3 5.9, $NaHCO_3$ 3.5, $Na_2B_2O_4$ 2.17, $Na_2B_4O_7$ 0.68. These findings are compared with those of Searles Lake brine in which $pH = 9.48$. The gram ions per l. of Borax Lake are 31.58, those of Searles Lake 444.5. L. W. Riggs (*C. A.*)

60. Suggestions for the standardization of geological sections of strata proved in boreholes, shafts, etc. H. Roscoe. *Colliery Guardian*, **122**, 1140–2(1921).—A standard comprehensive section of strata met with in coal, Fe and fire-clay mining is lacking. A list of conventional signs and colors which could be understood universally is suggested. C. C. Davis (*C. A.*)

61. A new method for determining silicic acid. Travers. *Compt. rend.*, **173**, 714–7(1921).—By treating a slightly acid soln. of an alkali silicate with KF in the presence of considerable K salt, the Si can be pptd. completely as K_2SiF_6 which can be titrated with alkali hydroxide in accordance with the following equations: $SiO_3^{--} + 6H^+ + 2K^+ + 6F^- \rightarrow K_2SiF_6 + 3H_2O$ and $K_2SiF_6 + 40H^- \rightarrow H_2SiO_3 + H_2O + 2K^+ +$

$6F^-$. Treat the soln. of alkali silicate in a Ag dish with at least 1 g. of KF for each 0.15 g. of SiO_2 present. Add HCl until the soln. is neutral to methyl orange and about 2 cc. in excess; then introduce 10 g. of KCl for each 40 cc. of soln. Filter the soln. using a hardened filter and an ebonite funnel. Wash the ppt. with 20% KCl soln., or with 50% alc. until the filtrate is no longer acid to methyl orange and then titrate the moist ppt. with 0.2*N* KOH, using methyl orange as indicator. The results obtained by this method are a little higher than those obtained by the conventional method, *e. g.*, 0.1238 g. SiO_2 instead of 0.1230 g. It is applicable for the detn. of Si in the presence of F and to silicate rocks when decomposed by fusion with KOH in Ag crucibles.

W. T. H. (*C. A.*)

62. An improved iron-manganese separation. M. Carus. *Chem.-Ztg.*, **45**, 1194 (1921).—In the usual basic acetate sept. of Fe^{+++} and Mn^{++} the first basic acetate ppt. is likely to contain a little quadrivalent Mn so that it is customary to dissolve the ppt. and repeat the basic acetate pptn. In as much as MnO_2 dissolves in dil. acid in the presence of H_2O_2 which does not at the same time reduce Fe^{+++}, it has been found possible to effect perfect sepns. of Fe^{+++} and Mn^{++} by a single basic acetate pptn. as a result of adding about 3 cc. of 3% H_2O_2 to the soln. just before introducing AcONa. The Fe ppt. should be washed with water contg. a little AcOH, some AcONa and a little H_2O_2.

W. T. H. (*C. A.*)

63. Molding sands: their origin and uses. A. Scott. *Colliery Guardian*, **122**, 1404–5(1921).—A general paper, including the physics and chemistry of such sands.

C. C. D. (*C. A.*)

64. Coagulation of colloids by electrolytes. H. D. Murray. *Chem. News*, **123**, 277–9(1921).—Work on the pptn. of colloids by added electrolytes is reviewed and references are given. The results of different investigators are not comparable because of lack of uniformity in treatment. Six facts seem to have an important bearing on the theory: (1) the sp. action of ions of opposite sign, (2) the greater effect of higher valency, (3) the modifying action of ions of same sign as the colloid, (4) the possible adsorption of equiv. quantities of ions, (5) a minimum necessary concn. of electrolyte, (6) the possible effect of an ion originally present. If work is to be comparable, 4 conditions are necessary; (1) uniform concn. of colloid, (2) quick and uniform mixt. of colloid with electrolyte, (3) uniform treatment after mixing and (4) uniform size of colloidal particles.

F. E. Brown (*C. A.*)

65. Catalysis in the interaction of carbon with steam and with carbon dioxide. Hugh S. Taylor and H. A. Neville. *J. Am. Chem. Soc.*, **43**, 2055–71(1921).—Steam was passed over C at 490°, 525°, and 570° and the vol. and compn. of the gases evolved detd. both in the presence and absence of catalysts. The reaction is (*a*) $C + 2H_2O = CO_2 + 2H_2$. The amt. of CO in the emergent gases was hardly measurable. This reaction takes place in 2 steps (*b*) $C + H_2O = CO + H_2$ and (*c*) $CO + H_2O = CO_2 + H_2$, of which (*c*) is the slower. Good catalysts for (*c*) such as iron oxide do not affect the velocity of (*a*) ; hence (*c*) reaches equil. under these conditions even in the absence of catalysts. Many substances of which K_2CO_3 is best are powerful catalysts for (*a*). The same substances are found to catalyze the reaction (*d*) $C + CO_2 = 2CO$. Adsorption measurements show that these catalysts increase the adsorption of CO_2 by charcoal. The results conform to the view that a surface complex C_xO_y is formed and the catalysts hasten the decompn. of this complex, thus cleaning off the surface for further adsorption of CO_2.

F. L. Browne (*C. A.*)

66. Diamond-drill sampling methods. R. D. Longyear. *Trans. Am. Inst. Mining Met. Eng.*, **1921**, No. 1107-M, 7 pp.—A brief description of methods for collecting and preserving diamond-drill samples with emphasis on making the sample contain all the core obtainable and all of the cuttings.

C. E. Carlson (*C. A.*)

67. Native antimony from Kern County, California. C. H. Behre, Jr. *Am. J. Sci.*, **2**, 330–3(1921).—The Sb from Kern Co. occurs as the core of nodules which are coated thinly with alteration products, (1) an unknown, black, Sb mineral, (2) yellow or white valentinite (?), (3) light stibiconite, and (4) a probable intermediate between (2) and (3). Edw. F. Holden (*C. A.*)

68. Thunder Bay District, Ontario. T. L. Tanton. Can. Dept. Mines, *Summary Report*, **1920**, Part D, 1–2.—Small but rich deposits of Ag ore on Silver Islet and vicinity were reopened in 1920, galenite and sphalerite being found. **Nipigon-Schreiber District, Ontario.** *Ibid.*, 2–7.—Mining claims were staked in this district as early as 1846. In this and subsequent years Zn, Pb, Cu, Ag, Au ores and anthraxolite were discovered, the Zenith mine being one of the earliest producing Zn mines in Can. At present the mining interests are connected with the Au deposits, and search for Ni in pyrrhotite. Anthraxolite was found on the C. P. Ry. 1 mi. west of Rossport; it is high in C and resembles anthracite, but is regarded as an altered liquid bitumen. **Oil possibilities of Manitoulin Island.** M. Y. Williams. *Ibid.*, 26–33.—An oil spring was discovered about 1650. Some drilling was done. The results of recent work prove that oil is not present in com. quantities. Logs of 5 wells are given. Analyses of 3 samples of oil gave 54, 48 and 46%, resp., of distillate below 350°. Oil shale of this region contained 65% ash and 35 volatile matter. B. t. u. per lb. 1720, oil yield per ton 7.7 U. S. gal., gas yield 740 cu. ft. per ton. B. t. u. of gas 540 per cu. ft. **Mesozoic clays and sands in Northern Ontario.** J. Keele. *Ibid.*, 35–9.—Washed cretaceous sand along the banks of the Missanaibi river contained SiO_2 97.72% and Fe_2O_3 0.32. The best clay deposit along the river contained SiO_2 53.10%, Al_2O_3 31.92, Fe_2O_3 1.52, H_2O 12.35, and was exceptionally high-grade as regards refractoriness. **Fluorspar deposits of Madoc District, Ontario.** M. E. Wilson. *Ibid.*, 41–78.—An av. of 16 shipments contained CaF_2 76.61%, $BaSO_4$ 8.13, $CaCO_3$ 9.11, (Al_2O_3, Fe_2O_3) 3.07, SiO_2 2.74. Along with CaF_2 in the fluorspar veins, in the order of their abundance are: barite, calcite, celestite, quartz, marcasite, pyrite, chalcopyrite, tetrahedrite, malachite, and elaterite. **Brockville-Mallorytown Map-area, Ontario.** J. F. Wright. *Ibid.*, 78–84.—Ore shipped analyzed 68% Fe, being either a hard, massive red hematite, or a sandstone impregnated with hematite. "No large body of ore will ever be found." L. W. Riggs (*C. A.*)

69. The theory of flotation. I. Traube. *Metall u. Erz*, **18**, 405(1921).—The flotation problem is a problem of colloid science. The ore pulp is a suspension. The particles in suspension sink under the action of gravity according to Stokes law, *i. e.*, the velocity of settling is proportional to the wt., the square of the radius of the particles and the difference between the sp. gr. of mineral and water, and inversely proportional to the viscosity of the water. To det. the action of other substances on the settling rate of the suspended particles the elec. charge of colloid particles must be considered. Most colloids are negative, including the gang minerals and according to Zsigmondy also the sulfides; however, according to Callow, Wageler and Zimmersbach the metal sulfides are positively charged and the flotation phenomenon is due to the attraction of the negatively charged oil drops by the sulfide particles. Ryschkewitsch's observations, however, do not support this latter view. The hydroxides of Fe and Al are electropositive, the fatty acids as well as aniline bases are negative and quinoline is positive. In general, sedimentation is increased by a colloid of opposite sign and decreased by one of the same sign. The same is true of the addition of ions. Negative suspensions are stabilized by the addition of alkali. The rate of settling is also lowered by the addition of colloids which increase the viscosity of water. The flotation process consists in a reversal of the settling process for some particles but not for others. This depends on the adsorption of the flotation agent on the ore minerals. In this connection the suggestion of Ryschkewitsch that the difference in adsorptive power of

gang and ore minerals is due to the fact that the gang materials have a mol. crystal lattice while the ore minerals have an ion crystal lattice is interesting. This adsorbed material lowers the interfacial tension. The amt. of this adsorption is notably affected by other acids and alkalies, the increase in adsorption of a fatty acid on galena by the addition of H_2SO_4 being particularly large. No adsorption by chalcopyrite could be detected by the stalagmometer in the case of cresol, amyl alc. and xylidine, but the ultramicroscope shows that an adsorption takes place. The particles with adsorbed flotation agent are adsorbed at the oil-water interface and thus become a part of the fröth, the formation of which depends on the lowering of the surface tension of the water by the flotation agent owing to the absorption of the latter. R. S. DEAN (*C. A.*)

70. Comments on various methods of attacking mineral ochers. A. RAYNAUD. *Bull. soc. chim.*, **29**, 905–10(1921).—A rapid proximate analysis of ochers may be made as follows: Dry the finely powd. sample at 105° and then heat over the burner to const. wt. This gives the moisture, hygroscopic and combined. Treat the anhyd. powder with HF and H_2SO_4 and, after evapg. to dryness, call the loss in wt. SiO_2. Fuse with $K_2S_2O_7$, take up in hot water and reduce the Fe with metallic Zn. Titrate with $KMnO_4$ and thus get the Fe_2O_3. Subtract the % of H_2O and Fe_2O_3 from 100 and call the difference Al_2O_3. W. T. H. (*C. A.*)

71. Formation and constitution of kaolin. V. J. BERNAOLA. *Anal. soc. quim. Argentina*, **8**, 392–400(1920).—A theoretical discussion of the mode of formation of kaolin and the supposed occurrence of cryst. particles associated with it. Assuming kaolin to be formed by the removal of Na, K, or Ca silicates from feldspars by soln., the formation of crystals is excluded and the cryst. forms observed are merely pseudomorphs after feldspars. The porous character of kaolin particles implied by its origin as a metasomatic product from feldspars would account for the plastic properties of clays. J. C. S. (*C. A.*)

72. The colloidal character of clay from the practical point of view. A. BENCKE. *China Clay Trade Rev.*, **3**, 188–9(1921).—A good review. C. H. K.(*C. A.*)

73. The flotation of sulfide ores in the laboratory. W. GROSS. *Metall u. Erz*, **18**, 483–6(1921).—The greatest difficulty with lab. tests is to get comparable grinding conditions. Closed ball mills give too much fine material; the best results are obtained with ball mills with sieves. The amt. of ore used is 5–1500 kg. and the necessary small amt. of flotation agent is added from a buret. For testing machines miniature Janny machines are obtainable and compressed air machines as the Grondal or Callow may be improvised. R. S. DEAN (*C. A.*)

74. The recently developed magnesite deposits in the Galgenberge, near Zobten, Silesia. L. VON ZUR MÜHLEN. *Z. prakt. Geol.*, **28**, 155–8(1920).—Compact magnesite occurs in veins in serpentine; it was probably deposited as a colloid from waters which had dissolved the Mg compds. from the upper portions of the serpentine, enriching the deeper part of the rock, and leaving a residual mass of Ni, Fe, and silica minerals. The magnesite later became finely cryst. EDW. F. HOLDEN (*C. A.*)

75. The bauxite deposits of the Vogelsberges. H. HARRASSOWITZ. *Metall u. Erz*, **18**, 557–77(1921).—The bauxite is a secondary deposit which was removed from its place of formation by ground waters and laid down in the Pliocene basin. Its first formation resulted from kaolinization of basalt, probably connected with climatic conditions. R. S. DEAN (*C. A.*)

76. Chromite in northern Macedonia. C. HÜTTER. *Z. prakt. Geol.*, **28**, 53–9 (1920).—Chromite is found at several places near Raduscha, in lenses in a serpentine carrying microscopic grains. The ore was probably concd. through magmatic differentiation in a periodotite, which later altered to serpentine; it carries 40–50% Cr_2O_3. E. F. H. (*C. A.*)

77. Manganese and manganiferous ores in 1920. H. A. C. Jenison. U. S. Geol. Survey, *Mineral Resources of U. S., 1920*, Pt. I, 271–83(preprint publ. Dec. 27, 1921). E. J. C. *(C. A.)*

PATENTS

78. Zinc oxide. New Jersey Zinc Co. Brit. 165,767, Jan. 14, 1921. In the production of ZnO by volatilizing Zn in a retort and burning the vapor, a considerable body of molten Zn is returned in the retort, and solid Zn is added from time to time in comparatively small quantities, the operation being practically continuous. A suitable construction is specified. Cf. *C. A.* **15**, 2531. *(C. A.)*

79. Purifying bauxite. E. Everhart. U. S. 1,397,414, Nov. 15. Bauxite ores contaminated with clay are disintegrated, agitated in a clay-deflocculating liquid such as dil. NaOH soln. until the clay substances are suspended and the suspended material is sepd. from the granular bauxite. *(C. A.)*

Refractories and Furnaces

80. The hardness of refractories at high temperatures. E. Rengade and E. Desvigness. *Céramique*, **25**, 33–37(1922).—The hardness of various silica-alumina

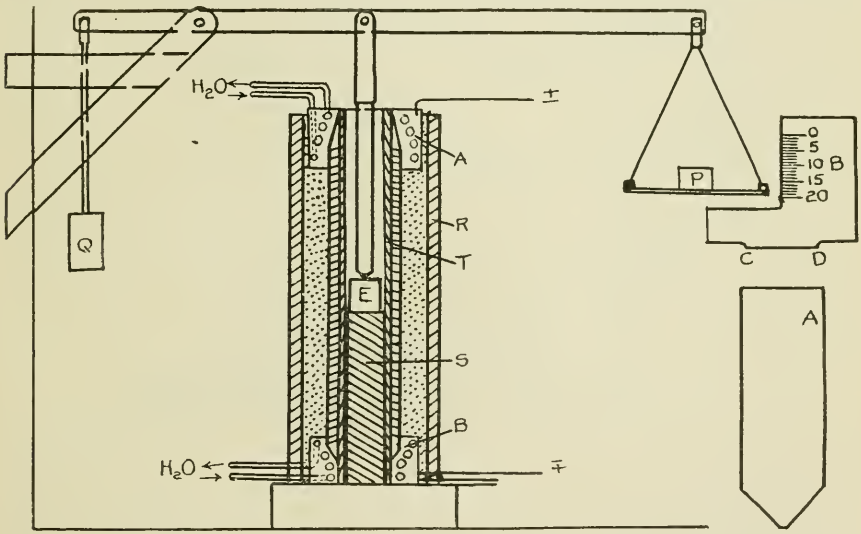

Fig. 1.

refractories were tested by heating small cubes of the material to high temps. in a carbon resistance furnace and forcing a cone-shaped graphite rod into the test piece with a load of 10 kgs. See Fig. 1. The cylinder of graphite has a diam. of 50–60 mm. with a 90° cone. The load is applied for 10 mins. and the impression thus made is measured. The temps. were obtained with an optical pyrometer. The results of the tests are shown in Fig. 2. The chem. analyses of the refractories are as follows:

	1	2	3	4	5	6	7	8	9
Loss on ignit.	0.20	0.15	0.20	0.54	0.40	0.20	0.25	0.25	0.22
SiO	70.90	85.20	80.80	72.70	71.60	70.62	57.80	67.20	26.80
Al_2O_3	23.60	11.30	14.72	20.00	21.00	25.80	37.50	29.07	61.70
CaO	0.35	0.20	0.45	0.20	1.15	0.80	0.60	0.90	1.30

	1	2	3	4	5	6	7	8	9
MgO	0.15	0.14	..	0.30	0.20	..	0.33	0.18	0.07
K_2O	1.30	0.91	1.90	1.00	0.18	tr.	tr.	..	..
Na_2O	..	..	..	0.45	0.18	tr.	tr.	..	..
Fe_2O_3	2.03	1.27	1.44	4.38	4.29	1.98	3.73	2.34	6.66
TiO_2	1.52	1.10	0.69	0.88	1.28	0.88	..	..	3.44
Fusion temp., °C.	1670°	1680°	1690°	1550°	1630°	1690°	..	..	1730°

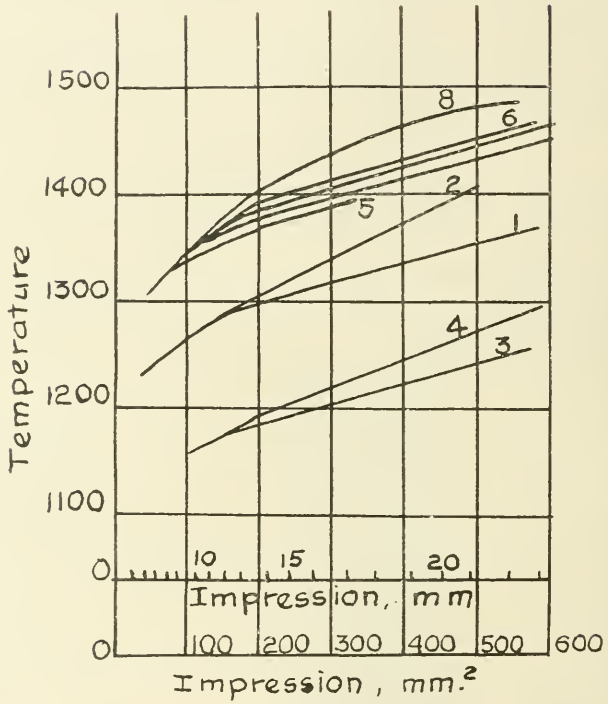

FIG. 2. H. G. SCHURECHT

81. **Report on refractory materials.** W. H. FULWEILER. *Gas Age-Record*, **48**, 653–4(1921).—Progress report of the Comm. on Refractories of the Am. Gas Assoc. For water-gas machine linings chromite, mica schist, and SiC have thus far proved unsatisfactory; zirkite and sillimanite are under observation. J. L. WILEY (*C. A.*)

82. **The operation of basic electric furnaces.** M. W. CARUTHERS. *Iron Age*, 109, 17–9(1922).—C. discusses at length the 8 major operations of making steel in funaces having movable electrodes. C. G. F. (*C. A.*)

83. **Industrial gas and industrial furnaces.** E. W. SMITH. *Gas J.*, **156**, 816–20 (1921).—S. discusses the industrial application of gas with especial emphasis on *surface combustion*. J. L. WILEY (*C. A.*)

84. **Surface combustion.** H. LININGER. *Z. Ver. Gas-Wasserfach*, **61**, 117–22 (1921).—L. describes the principles, the advantages, the applications and the app. therefor of the surface combustion method of heating as developed by the Surface Combustion Co. of N. Y. J. L. WILEY (*C. A.*)

85. Comparative calculations on the subject of producer gas in case steamis added to the blow air. J. SEIGEL. *Rev. metal.*, **18**, 608–18(1921); cf. *Jour. Am. Ceram. Soc.*, **4**, 1008.—Mathematical and graphical calcns. on the variations in calorific power per m.^{3} of gas, in calorific power per vol. of gas obtained from 1 kg. of fuel, and in the temp. of combustion, when the content in H varies. If different producer gases possess the same potential heat per kg. of fuel, the calorific powers per cu. m. and the temps. of combustion can be diminished only by raising the content in H of the gas. There is no advantage to be expected by injecting steam into the producer either in connection with the yield of potential heat units or in the quality of the gas (the calorific power per m.^{3} and the temp. of combustion). The real advantage is obtained in decreasing the amt. of clinker formed and in avoiding fuel losses in the clinker; beyond that point the addition of steam is detrimental. J. L. WILEY (*C. A.*)

86. Moore gas producing system. ANON. *Gas World*, **75**, 451(1921); fig.—In the Moore system, water gas and coal gas are produced in the same app., which comprises a generator having a vertical retort, of smaller cross-sectional area, in its upper part surrounded by a checkered chamber, primary and secondary air blasts being employed, the latter being utilized to burn the gases from the blow in the checkered chamber, the whole being enclosed in a surrounding shell and the fuel being supplied from the top through a coal valve. Both the feed of coal and extn. of the coke are performed without disturbing the gas-making process. About 35,000 cu. ft. of 425–450 B. t. u. town's gas are produced per ton of coal. The plant can be adjusted for partial or complete gasification. Tar and available NH_3 content of the coal are recoverable. A 500,000 cu. ft. per day plant is to be built at Scunthorpe, Eng. J. L. WILEY (*C. A.*)

87. The use of automatic stokers for high-temperature metal-heating furnaces. F. VERDEAUX. *Technique moderne*, **13**, 414–7(1921).—The consumption of slack coal (6,600 cal.) per sq. m. of radiating surface (taken equal to the surface of the arch over the grate and extending to the bridge) is given by $C = 3(T_o + T)/(T_o - T)$, where C is the consumption, T the temp. at the bridge, and T_o is 1450° when dry air is blown through the grate and 1400° when steam is used. T is generally 100–50° higher than t, the working temp. A large decrease in output corresponds to a relatively small decrease in coal consumption, owing to the very high temp. Therefore close supervision is required for even automatic stokers. A. PAPINEAU-COUTURE (*C. A.*)

88. Investigation of refractory materials: the after-contraction test. D. A. JONES. *Gas World*, **75**, 422(1921); *Gas. J*, **156**, 498–9(1921).—Preliminary report from the Inst. of Gas Engineers' Refractory Materials Comm. Whole bricks, not small pieces, are used. The bricks are heated in a surface combustion furnace, the heat being raised for 4 hr. and maintained at the max. temp. (cone 14 for fire brick and cone 12 for silica brick) for 2 hr. Considerable diversity is shown in the readings on account of the unevenness of the surfaces and the dislocation of the surfaces after firing. Marks should be made on the brick, and the variation between these measured by reading microscopes. J. L. WILEY (*C. A.*)

89. Reversible thermal expansion of silica. H. S. HOULDSWORTH AND J. W. COBB. *Colliery Guardian*, **122**, 1003(1921).—On burning, the quartz first undergoes a permanent linear expansion, with little or no decrease in d., but an increase in porosity. Further burning to cone 14–16 alters the expansion curve, the quartz being more or less completely changed to crystobalite. A detn. of the true d. of the powdered brick is the best guide to its expansion behavior. C. C. DAVIS (*C. A.*)

90. Steel-works furnaces and gas producers. J. S. ATKINSON. *J. West Scotland Iron & Steel Inst.*, **29**, 4–14(1921).—A discussion of the design and operation of mechanical gas producers; of the Stein type of recuperative furnaces and soaking pits; and of American, British, and continental European open-hearth furnaces. Data are given

from comparative runs of similar producers with and without the Chapman floating agitator. The results were in favor of the use of the agitator. Gas-fired furnaces are regenerative, recuperative, or without either regeneration or recuperation. Each type has definite and limited applications. The principal causes of failure in faultily designed recuperators are discussed and the Stein recuperator is described in detail. In discussion J. Mitchell and R. P. Smith express doubt that agitation of the fuel bed of gas producers is an advantage in all cases. LOUIS JORDAN (*C. A.*)

91. Garrister, its production and uses. Consultation column. *Eng. Min. J.*, **112**, 537. Brief summary mainly from U. S. G. S. reports. S. L. G.

PATENTS

92. Zinc-smelting furnace. B. RAEDER. Can. 214,692, Dec. 13, 1921. An elec. furnace for Zn production has a chamber heated with energy supplied through C electrodes, a superposed chamber for drying and glowing heated by the combustion of gas and a drying compartment above the latter chamber. The charge is fed successively through the 3 compartments. (*C. A.*)

93. Basic refractory brick. S. B. NEWBERRY. U. S. 1,400,087, Dec. 13. A mixt. of lime 2.10 and argillaceous material 3.35 parts is calcined, the proportions of the resulting materials being such that the clinker formed will not disintegrate after prolonged heating or exposure to the air. A mixt. of lime and clay or the like of greater fusibility is added to the clinker and the mixt. is molded and burned as usual in making fire brick. (*C. A.*)

94. Perforated arch and brick therefor. ALFRED H. WILLETT. U. S. 1,395,542 Nov. 1, 1921. In an arch construction for fire boxes provided with supporting tubes, the combination of a plurality of reversible fire bricks adapted to be supported in rows upon the tubes, each of the fire bricks being narrower at one end than at the other so that if the bricks in a row be assembled with narrow and wide ends alternating in the adjacent bricks an imperforate arch will be formed, but if assembled with all wide and all narrow ends together, a perforate arch will be formed. C. M. S., JR.

Art

95. Coloring doll heads. ANON. **53**, 486–487(1922).—A new process for coloring doll heads is described. The body must have a high feldspar content, 30%, since high silica bodies become violet. The compn. of the bodies are as follows:

	CASTING BODY		
Norwegian feldspar	31.52	Norwegian feldspar	31.54
Lime feldspar	3.05	Whiting	3.05
Zettlitzer kaolin	52.87	Zettlitzer kaolin	51.45
Quartz	12.56	Löthainer clay	2.00
	100.00	Quartz	12.00
			100.04
Soda	0.2		
Water	79.0		

14% of a mixt. composed of 100% $Al(OH)_3$ and 30% $MnSO_4$ dissolved in water is added to the body given above. The mixt. is heated to Seger cone 02*a* in a muffle kiln. The calcine which is now a rose color is then treated with 10% $(NH_4)_3PO_4$ dissolved in water. It is then boiled with 8% H_2SO_4 soln. and after drying and grinding is ready for use. The firing should be done in a strictly oxidizing furnace atmosphere, since the iron compounds cause a yellow coloring when not reduced. This yellow together with the Mn rose produces the flesh color. The color is painted on the doll heads by artists and is then fired at low temps. H. G. SCHURECHT

96. **Production of iridescent effects (interference phenomena) for the manufacture of imitation mother of pearl.** F. J. G. Villforth. *Kunststoffe*, 11, 153–5, 162–4 (1921).—Review of patent literature. C. J. West (*C. A.*)

Abrasives

PATENTS

97. **Abrasive.** W. Martinoff. Brit. 166,713, April 21, 1920. Clay free from arenaceous quartz is heated to 1500–1800° until it becomes grey or black, according to the color of clay used. The material is ground and used as a substitute for emery in abrasive wheels. (*C. A.*)

98. **Grinding compounds.** W. P. Thompson. Brit. 169,868, July 27, 1920. An abrasive compd. used with H_2O for metal work consists of powd. carborundum distributed in a jelly of water and starch, flour, or other water-sol. glutinous binder. (*C. A.*)

Heavy Clay Products

PATENTS

99. **Drain-tile.** Emory E. Trowbridge. U. S. 1,393,329, Oct. 11, 1921. In drain tiles the combination with a pair of abutting tubular members, of an enlarged flange portion secured to the end of one tile member and fitting around the abutting end of the other tile, a cup shaped portion carried by the flange and adapted to collect the moisture from the subsoil and permit the seepage through the tiles into the system. C. M. S., Jr.

100. **Hollow tile.** Jacob Voorhis Close. U. S. 1,395,176, Oct. 25, 1921. A building tile having a plurality of differently shaped vertical openings, sundry of the openings having one end wall recessed, the opening at one end of the tile having its outer end wall provided with wire cuts to permit its removal to form a recess at the end of the tile, the side walls of the openings having a recessed end wall being provided with wire cuts, whereby a number of differently shaped units can be formed from the tile, each having a recess in one end. C. M. S., Jr.

101. **Brick.** James Alexander Papot. U. S. 1,394,759, Oct. 25, 1921. In a wall construction, bricks arranged to provide opposed stretcher rows, alternate built-up sections disposed between the stretcher rows, one of the sections including bricks laid on their side faces and having their adjacent edges disposed in spaced relation to provide a passageway, the adjacent section including bricks laid on their side faces, and bricks positioned on upper side faces of the latter bricks. C. M. S., Jr.

102. **Roofing-tile.** Richard Joseph. U. S. 1,395,423. Nov. 1, 1921. In a roofing tile, a body of plastic material, a transverse rib arranged to engage the roofing strip and a hooked member slidably mounted through the rib and arranged to engage the roofing strip. C. M. S., Jr.

103. **Manufacture of bricks.** Walter William Crawford. England 1,395,990, Nov. 1, 1921. The method of mfg. bricks and the like, which comprises burning a suitable gangue in an oxidizing atmosphere, then mixing the burned material with a relatively small quantity of dehydrated cement, then moistening the mixture and pressing the same into form, then immersing the pressed form in cold water, and finally drying the pressed bricks at a low temp. C. M. S., Jr.

104. **Arch-protector for clamp-kilns.** Frederick Gleckler. U. S. 1,396,189, Nov. 8, 1921. In a kiln of this class, the combination with a ware arch extending from a furnace opening in the kiln wall, of loosely positioned brick forming a sub-arch or tun-

nel within the ware arch from the furnace, with the spaces between the bricks forming lateral distributing openings for the flame and hot gases of combustion from the sub-arch and into the ware arch. C. M. S., Jr.

105. Brick-cleaning machine. Edward L. Minor. U. S. 1,397,227, Nov. 15, 1921. A rotatable rack having a concentric series of axial supports with floating metallic disks mounted thereon, and a bed above which the peripheries of the rotating disks will project to engage an article thereon to be cleaned. C. M. S., Jr.

106. Paving-brick. Frank B. Dunn. U. S. 1,397,505, Nov. 22, 1921. As an article of manuf. an unpressed paving brick cut from a continuous column of clay having two transverse grooves in one of the die-formed surfaces thereof, and perimetrical studs projecting from the surface of the die-formed surface adjacent to the same relative side of each of the transverse grooves. C. M. S., Jr.

See Abs. 120.

Glass

107. Effect of sulphate and carbonate of sodium on the heats of fusion of soda-lime glass batches. Emille Fourcault. *Le Verre*, 251–54(1921); 6–9(1922).—A glass 75.3% SiO_2, 12.9% Na_2O, 11.8% CaO, *i. e.*, $Na_2O.CaO.6SiO_2$ is taken for an example. The sp. ht. of the glass is calcd. by the law of Woestyn where $C = \frac{a_1}{100} \times e_1 + \frac{a_2}{100} \times e_2 + \frac{a_n}{100} \times e_n$ in which C = sp. ht.; a = per cent compn. of oxide; e = corresponding constant. At 0° $Co = \frac{75.3}{100} \times 0.1913 + \frac{12.9}{100} \times 0.2674 + \frac{11.8}{100} \times 0.1903 = 0.20$. For a temp. $t°$ the sp. ht. is $C_t = Co\ (1 + \alpha t)$ where $\alpha = 0.00078$. For the mean sp. ht. between 0° and $t°$ $C_{mt} = Co(1 + \frac{\alpha t}{2})$. Values for the Co are SiO_2 0.1913, NaO_2 0.2674, Na_2CO_3 0.273, Na_2SO_4 0.231, CaO 0.1903, $CaCO_3$ 0.215; for C_{mt}, where $t°$ = 1500°, glass 0.317, Na_2CO_3 0.433, Na_2SO_4 0.366, $CaCO_3$ 0.341, SiO_2 0.302. The following factors are taken into consideration: (1) *The heat required to bring each constituent of the batch to 1500°.* This is calcd. from the C_{mt} data on a mol. wt. basis:

	A		B	
	Kgs.	Calories	Kgs.	Calories
Na_2CO_3	106	68,847	..	....
Na_2SO_4	..	....	142	77,958
$CaCO_3$	100	51,150	100	51,150
SiO_2	360	163,080	360	163,080
		− 283,077		− 292,188

Each batch (A or B) gives 478 Kgs. of glass. (2) *Heat absorbed during decompn.* To decompose 1 Kg. of Na_2CO_3 713.2 cal. per Kg. are required, for Na_2SO_4 952.8, for $CaCO_3$ 451.5 cal. For Batch A, 120,750 cal. are absorbed, and for B, 180,450 cal. (3) *Heat necessary to melt the new silicates formed, and also the excess silica.* The silicates formed will be Na_2SiO_3 0.26, $CaSiO_3$ 0.24, with excess SiO_2 0.50, as mol. per cent. The hts. of fusion are per Kg. Na_2SiO_3 30 cal., $CaSiO_3$ 27.3 cal., SiO_2 30 cal. For 478 Kgs. of glass 14,025 cal. are needed. (4) *Heat liberated by the formation of the silicates.* For Na_2SiO_3 65,000 cal. per Kg., and for $CaSiO_3$ 35,000 cal. per Kg. are liberated. The net results are:

	A	B
(1) Heating mixt. to 1500°	− 283,077 cal.	−292,188 cal.
(2) Decompn. of carbonate and sulphate	− 120,750 cal.	− 180,450 cal.
(3) Heat of fusion of silicates	− 14,025 cal.	− 14,025 cal.
(4) Heat of formation of silicates	+ 100,000 cal.	+ 100,000 cal.
Heat absorbed by 1 Kg. mole. of glass	− 317,852 cal.	− 386,663 cal.
Or by 1 Kg. of glass	− 665 cal.	− 808 cal.

Calcns. for 2 other glasses are given: Belgian blown glass, per cent compn. SiO_2 71,850, CaO 14,274, MgO 0.070, Al_2O_3 0.522, Fe_2O_3 0.290, Na_2O 12.944, mol. compn. 0.85 Na_2O, 1CaO, 4.55 SiO_2. Ht. absorbed per Kg. of glass, for carbonate 583 cal., for sulphate 736 cal., Belgian drawn glass, per cent compn. SiO_2 73.647, CaO 11.080, MgO 0.91, Al_2O_3 0.494, Fe_2O_3 0.303, Na_2O 14.385, corresponding to 1.19 Na_2O, 1CaO, 6.13 SiO_2. Ht. absorbed per Kg. of glass for carbonate 678 cal., for sulphate 842 cal. LOUIS NAVIAS

108. The relation between the density and composition of glasses. W. L. BAILLIE. *J. Soc. Chem. Ind.*, **40**, 141–48(1921).—See Abs. **55**, *These Abs.*, **1**, 19(1922). (*C. A.*)

109. The manufacture, properties, and employment of heat-intercepting structural glass. G. ALLEMAN. *J. Soc. Chem. Ind.*, **40**, 241–2T(1921).—The batch for this *actinic glass* as made by the Penna. Wire Glass Co. and expressed in lbs. is SiO_2 1300, Na_2CO_3 400, $Na_2B_4O_7$. $10H_2O$ 20, CaO 200, $NaNO_3$ 40, with decolorizers expressed in g. MnO_2 85, TiO_2 30, "nickel oxide" 35, and 40 lbs. of artificial biotite. The artificial biotite consists of micaceous hematite 40, pptd. Al_2O_3 5, "solid Na silicate" 50, magnesite 5, and MnO_2 30 g. Specimens of this glass 1/4 in. thick transmit 42% of light, eliminating all glare and absorb 78% of heat. The transmission of the luminous rays by different forms of glass varies considerably: Plain polished plate 92.26% of transmission; plain polished wire 68.76%; plain aqueduct wire 40.88%; plain cobweb wire 46.98%; plain ribbed wire 41.96%; plain corrugated wire 44.45%; actinic polished plate 42.02%; actinic rough wire 39.74%; actinic aqueduct wire 21.48%; actinic ribbed wire 32.57%; actinic corrugated wire 29.88%. The transmitted light measured included only that which emanated perpendicularly from the face of the glass. The following figures show the amt. of illumination (due to reflection as well as transmission) in houses of various kinds of glass: Plain polished plate 94.3% of illumination; plain aqueduct wire 81.8%; plain ribbed wire 81.7%; plain corrugated wire 86.0%; actinic rough wire 72.7%; actinic aqueduct wire 47.2%; actinic ribbed wire 77.3%; actinic corrugated wire 77.0%. The wire glass is fire-proof and retains its strength when cracked being suitable roofing material. The glass also finds use in containers of chemicals sensitive to light and heat, and as windshields. It reduces glare in the latter case, and it is claimed is an improvement over ordinary plate glass in aiding the vision when the windshield is covered with raindrops. J. B. PATCH (*C. A.*)

PATENTS

110. Sheet-glass drawing machine. ROBERT P. CALLARD and CLARENCE A. RHONEMUS. U. S. 1,393,081, Oct. 11, 1921. In a continuous sheet glass drawing machine, the combination of a receptacle for molten glass having oppositely-disposed overflow portions, and sheet drawing and width maintaining means, comprising an endless series of edge molding devices movable vertically past each of the overflow portions, for forming the sheet edges and holding them laterally while simultaneously drawing the sheet upward. C. M. S., JR.

111. Manufacture of glass articles. ROBERT FREDERICK HALL. England 1,393,118. Oct. 11, 1921. A machine for the manuf. of glass articles comprising a supporting frame, an upper and a lower elongated endless carrier supported in the frame and parallel to each other, the carriers having their opposite faces in proximity to each other during a portion of the travel, means for concomitantly moving the carriers in opposite directions whereby the opposed faces move together throughout a portion of their travel, a series of molding devices on the lower carrier comprising parison and finishing molds, a series of upper mold sections on the upper carrier and adapted to coöperate with the finishing and parison molds, and automatic means for operating the parison molds and upper mold sections for forming glass articles during the portion of travel when the finishing and upper mold sections are moved together in opposed relation. C. M. S., JR.

112. **Method and apparatus for drawing sheet-glass.** JOSEPH E. CROWLEY. U. S. 1,394,283. Oct. 18, 1921. The process of mfg. sheet glass, comprising the simultaneous drawing of a plurality of sheets, passing the sheets about a bending roll in separable contact with each other, continuing the drawing in a plane while still in contact and finally separating the sheets. C. M. S., JR.

113. **Machine for making hollow glass-ware.** EDWARD S. HUTTON. U. S. 1,394,092. Oct. 18, 1921. A machine for making a hollow glass-ware, including a rotary table, a mold holding frame mounted in the table with guideways in the sides thereof, a blank mold, a blow mold, each of the molds being formed of two vertical halves, stationary means on the outer end of the frame for securing the two outer halves of the molds, a block movable in the frame for holding the two inner halves of the molds, a rod connected with the inner block for moving the inner halves of the molds for opening and closing the molds, the block being radially slidable, and stationary cams near the center of the machine for engaging the inner end of the rod and forcing it inwardly and outwardly. C. M. S., JR.

114. **Glass composition and method of making same.** ELBERT E. FISHER. U. S. 1,394,296. Oct. 18, 1921. A glass comprising more than 60% of silica, one or more oxids of the second periodic group having a thermal expansion of less than 4 as compared to silica, and not more than about 6% of alkali metal oxids of the first periodic group. C. M. S., JR.

115. **Process of manufacture of a glass using natural silicates, such as micaceous minerals, asbestos, and the like.** PERCY BROADBENT CROSSLEY. Calcutta, India. 1,394,973. Oct. 25, 1921. The method of manufacturing glass which comprises dissolving mica in molten glass and maintaining the temperature below that at which the mica effervesces. C. M. S., JR.

116. **Glass roll.** KENJI MATSUO. Tokyo, Japan. 1,394,684. Oct. 25, 1921. A roll consisting of a steel pipe the outer surface of which is perfectly smoothed and covered with a layer of milk glass which is rich in metallic constituents, substantially as and for the purposes herein before set forth. C. M. S., JR.

117. **Process and apparatus for drawing sheet-glass.** IRVING W. COLBURN. U. S. 1,394,809. Oct. 25, 1921. The method of forming sheet glass, consisting in providing a slab within a heated chamber and projecting the discharge end thereof into a temp. which is less than that of the chamber, and causing molten glass to flow onto the slab within the chamber and to be drawn from the discharge end thereof. C. M. S., JR.

118. **Glass-discharging mechanism.** EDWARD S. HUTTON. 1,394,677. U. S. Oct. 25, 1921. The combination of a glass tank, a glass discharge member extending through the wall thereof with its ends projecting beyond the wall, the member having a relatively large glass receiving chamber opening downward in the inner portion thereof and a glass conduit of relatively smaller dimensions in cross-section than the receiving chamber and which extends from the upper end of the receiving chamber at an upward inclination to the discharge end thereof, and means for causing a sudden rising of the glass in the outer portion of the conduit for causing the discharge therefrom of a gather of glass. C. M. S., JR.

119. **Glass-delivery apparatus.** RICHARD T. MCGEE. U. S. 1,394,920. Oct. 25, 1921. Glass delivery app., comprising, in combination with a melting tank, a well located at a suitable distance from the tank, a passage for glass leading outward from the tank in the general direction of the well, a second passage located on a lower level than the first passage, the second passage being in open communication with the well and being adapted to receive glass by gravitation from the first passage and means for producing glass displacement within the second passage for ejecting glass from the mouth of the well. C. M. S., JR.

120. Manufacture of bricks. Friedrich Brettschneider. Moravia 1,395,173. Oct. 25, 1921. The process for making bricks which consists in charging plastic material into a mold-frame closing the frame and applying pressure to cause the excess-charge to escape and to be cut off between the mold-frame and cover plates, the pressure being then maintained until the rest of the excess-charge resulting from the elasticity of the mass has escaped through apertures provided for this purpose.

C. M. S., Jr.

See Heavy Clay Products.

121. Method of and apparatus for forming glass tubes. Karl Kuppers. Germany 1,395,963. Nov. 1, 1921. A process for the production of reinforced glass tubes which comprises placing a skeleton body upon a suitable mandrel, then placing a glass tube upon the skeleton body and the mandrel, closing one end of the glass tube, evacuating the tube, sealing the other end of the tube, and heating the tube by means of a suitably heated ring-shaped member with relative movement of the tube in order to heat its entire surface whereby the glass passes through the interstices of the skeleton body and conforms to the shape of the mandrel. C. M. S., Jr.

122. Glass-melting furnace. Lambton Le Breton Mount. England 1,395,591. Nov. 1, 1921. A glass melting furnace comprising a tank for molten glass having raised bottom regions at opposite sides, and a vertical flow feed outlet through each such region, a bridge beneath which the molten glass is constrained to flow before reaching the raised bottom portions, fluid fuel burning means at and above one end of the tank, a recuperator at the opposite end thereof, and a casing having recesses below the raised bottom regions of the tank for the reception of molds into which the glass is to be delivered. C. M. S., Jr.

123. Cooling device for glass-drawing apparatus. Walter A. Jones. U. S. 1,396,216. Nov. 8, 1921. A cooling device comprising a stationary support, a cooling ring formed of complemental sections movably mounted upon the support independently of each other, and means for supplying a cooling medium to the sections.

C. M. S., Jr.

124. Art of ornamenting glass articles. John A. Milliken. U. S. 1,396,691. Nov. 8, 1921. An improvement in the art of ornamenting hollow glass articles comprising inserting a chuck into the article without contacting therewith, temporarily attaching the chuck and the article by an interposed material capable of being applied in molten condition, subjecting the article to the action of an ornamenting apparatus by connecting the chuck and the attached article to the apparatus, and finally changing the physical condition of the interposed material to permit of separation of the chuck and the attached article. C. M. S., Jr.

125. Method of casting plate-glass and apparatus therefor. John W. Kunzler. U. S. 1,396,330. Nov. 8, 1921. The method of casting plate glass, comprising the steps of continuously feeding molten glass into a tiltable vessel, periodically tilting the vessel to pour the molten glass therein onto a casting table across the face thereof, and during such pouring operation moving the table in a direction at right angles to the axis of the vessel to spread the glass in the form of a sheet on the table and during such movement moving the table and glass under a sheet-forming roller to roll the glass to the required thickness. C. M. S., Jr.

126. Sheet-glass forming apparatus. Michael J. Owens. U. S. 1,397,326. Nov. 15, 1921. In a sheet-drawing app., a receptacle for molten metal, a sheet drawing means, and an intermediate sheet bending device having a non-glaze destroying face running in contact with the glass at a point distant from the point of formation, the surface of the glass being free from contact with any solid substance until a surface glaze has formed thereon, the movement of the face being different from that of the glass.

C. M. S., Jr.

127. Process of making plate-glass. JOHN H. MCKELVEY and CHARLES F. RYAN. U. S. 1,397,287. Nov. 15, 1921. The process of making plate glass consisting in first melting the constituents in a furnace, tank, or the like, then conveying and segregating a portion of the molten glass in a collection chamber, then treating the portion by subjecting it to a heat independent of and controlled independently of the furnace for such period of time and at such temperature as to refine such portion, and thereafter depositing the molten glass directly upon a subjacent rolling table and finally rolling same. C. M. S., JR.

128. Machine for and method of making corrugated wire-glass. ARNO SHUMAN. U. S. 1,397,149. Nov. 15, 1921. The method consists in rolling a corrugated sheet of wire glass and repeatedly pressing the same corrugated parts of the rolled sheet while still hot. C. M. S., JR.

129. Sheet-glass drawing machine. ORLAN P. MARCONET and WILLIAM O. CARTER. U. S. 1,398,109. Nov. 22, 1921. In a machine for mfg. sheet glass, a furnace, means for drawing the molten glass from the furnace, water jackets arranged immediately above the molten mass and at the opposite sides of the furnace, the jackets being designed to receive the edges of the sheet in a manner whereby the edges are cooled and hardened, and also thickened so that the sheet glass lying between the edges is afforded straightness and uniformity in width, and a water inlet and outlet for each jacket. C. M. S., JR.

130. Glass-rolling mechanism. JACOB SODERBERG. U. S. 1,398,046. Nov. 22, 1921. In combination in glass rolling mechanism, a table, a roll, supporting tracks extending along the sides of the table on which the roll rests, means for rotating the roll to cause it to move back and forth along the table, and means for automatically lifting the roll from the tracks when it reaches one extreme of movement, comprising a tilting cradle provided with rollers for engaging the roll and supporting it for rotation. C. M. S., JR.

131. Method for producing flat parallel-shaped glass sheets. WILLIAM H. TAYLOR. U. S. 1,398,050. Nov. 22, 1921. The process of securing a plate to a flat bed which consists in applying the plate to the bed forcing a mixture of plaster and liquid between the plate and the bed, and allowing the plaster to set. C. M. S., JR.

Enamels

132. Uses for industrial enameled equipment. MAX DONAUER. *Chem. Met. Eng.*, **25**, 1015–20(1921).—Glass enameled units, 25 to 7500 gal., serve 3 general uses, food, pharmaceutical and chem. Advantages over other containers are discussed. R. J. M. (*C. A.*)

Cement, Lime and Plaster

133. Influence of drying on the resistance of cement briquettes. F. ANSTETT. *Rev. Mat. Constr. Trav. Pub.*, **148**, 1–2(1922).—Briquettes of artificial cement, slag cement and of 1/3 mortars with sand of each, were made, and completely immersed in water 24 hrs. after the mixing, for periods of 7, 37 and 90 days. Tensile strength tests were made on some pieces, immediately after removal from the water, and on others at periods of 7, 20 and 26 hrs. after removal from the water. In all cases, the strength of the body was greatest when tested immediately after removal from the water. The strength decreased markedly as the period from the time of removal increased. A. advocates that specifications for such tests be made on the sample immediately after removal from the water. LOUIS NAVIAS

134. Manufacture and use of concrete building blocks. *Rev. Mat. Constr. Trav.*

Pub., **145**, 190–92, **146**, 209–11, **147**, 233–34(1921).—A general description of the materials and methods for making agglomerate. The use of building blocks advocated.

LOUIS NAVIAS

135. Egyptian lime-silica brick. A. DUPRAZ. *Rev. Mat. Constr. Trav. Pub.*, **147**, 234–36(1921).—General description of 3 lime-silica brick plants in the vicinity of Cairo, Egypt.

LOUIS NAVIAS

136. Method of chemical analysis of gypsum and plaster. A. R. *Rev. Mat. Constr. Trav. Pub.*, **147**, 232(1921).—I. *Free water.* By the loss of wt. of a 500 gm. sample heated 2 hrs. at 45°. II. *Fineness of grain.* By screening with the least abrasion. III. *Chemical analysis* made on a 100 mesh sample, dried as in I. (*a*) *Combined water.* 1 gm. charge heated at 215–230° to constant wt. (*b*) CO_2 *determination.* The charge from (*a*) is dissolved in 1:4 HCl, and the CO_2 collected over soda lime or caustic potash. The increase in wt. is the wt. of CO_2. (*c*) *Silica and insoluble matter.* Heat $^1/_2$ gm. sample in a porcelain crucible with 25 cc HCl (1 : 5), to dryness, cool, moisten with conc. HCl, add 10 cc. water, boil, and then filter. Return filtrate to crucible, evaporate to dryness, heating it at 120° for 1 hr., moisten residue with conc. HCl, add 25 cc. water, boil and then filter. Combine the 2 residues, ignite and weigh. (*d*) *Iron and alumina.* The filtrate from (*c*) is boiled with a few drops of conc. HNO_3. Add 2 gms. of NH_4Cl in a water soln. and make the soln. alkaline with NH_4OH. Heat so as to coagulate the precipitate, then filter. Ignite and weigh as Fe_2O_3 and Al_2O_3. (*e*) *Lime.* Two methods. (1) To the ammoniacal filtrate from (*d*) add 5 gms. $(NH_4)_2$ dissolved in water, ht. for $^1/_2$ hr., filter. Ignite in a platinum crucible to constant wt. (2) Precipitate and filter as in (1). Transfer the precipitate to a beaker, and re-dissolve it with dilute H_2SO_4. Titrate the soln. while hot with $KMnO_4$ soln. (containing 5.6339 gm. per liter), the number of cc. giving directly the CaO. (*f*) *Magnesia.* Dilute the filtrate from (*e*) to about 600 cc.; cool, add 10 cc. NH_4OH and 5 gms. NH_4NaHPO_4 dissolved in water, stir till precipitate forms. The following day, filter and wash with $2^1/_2\%$ NH_4NO_3 soln., ht. and weigh. Multiply the wt. found by 40/111 for the magnesia. (*g*) *Sulphur trioxide.* Dissolve $^1/_2$ gm. of prepared sample in 50 cc. of 1 : 5 HCl, boil, add 100 cc. of boiling water and continue to boil for 5 min. Filter immediately and wash with hot water. Boil the filtrate, add to it 20 cc. of a soln. of $BaCl_2$ (10% soln.). Let settle for an hr., filter and wash. Ignite with as low a flame as possible till the paper is charred, then strongly for 15 min. Weigh. Multiply the wt. by 80/233 for the wt. of SO_3. (*h*) *Sodium chloride.* Dissolve 1 gm. of prepared sample in boiling water, filter. Add 2 or 3 drops of potassium chromate to the filtrate, and titrate with N/20 silver nitrate soln. 1 cc. of standard is equivalent to 0.002923 gm. NaCl.

LOUIS NAVIAS

137. Portland cement—its testing and specification. R. E. STRADLING. *Concrete and Constr. Eng.*, **16**, 169–77, 223–33(1921).—A critical discussion of Am., Brit., French and Ger. cement specifications, and cement-testing app. The essential properties of cement as an engineering material are setting time within workable limits, soundness (*i. e.*, no disintegration with aging), and strength sufficient for requirements. When cement is mixed with water a considerable portion of it usually does not hydrate. Every effort should be taken to increase the hydrated portion since the unhydrated portions might more cheaply be replaced with sand. The hydration is apparently affected by (1) fineness of grinding, (2) manner and amt. of mixing, (3) amt. of water used and (4) temp. of water used. The essentials of cement testing are (1) real indications of suitability of the material for the work in hand, (2) independence of the personal equation and (3) shortest possible time.

J. C. WITT (*C. A.*)

138. Japanese standard rules for testing Portland cement. ANON. *Eng. World*, **18**, 273–4(1921).

J. C. WITT (*C. A.*)

139. Heat efficiency increase in cement burning. H. Lamour and W. C. Stevenson. *Concrete* (Mill Sect.), **19**, 95–6(1921).—A proposed preheater for cement raw mix is discussed. The app. consists essentially of a vertical cylinder, divided into several chambers, placed above the upper end of a rotary kiln. The kiln gases on their way up the stack are diverted and passed through the preheater where some of the heat is absorbed and some of the dust is recovered. Expts. indicate that the temp. of the gases leaving the preheater is below 700°F and it is calcd. that the installation of a preheater will result in a saving of 24% of the fuel. J. C. Witt (*C. A.*)

PATENTS

140. Device for dry granulation of slag. F. Riedel. Assr. to The Chemical Foundation, Inc. U. S. 1,404,142, 17.1.22. Appl., 10.8.15. A device for dry granulation of slag comprises a cylindrical cooling wall, an atomising nozzle mounted so as to permit movement in all directions, and means for passing compressed ejecting medium through the nozzle, so that the molten slag may be thrown in a radial direction at any portion of the cooling wall. H. S. H. (*J. Chem. Ind.*)

141. Cement-kiln plant and method of operating the same. John E. Bell. U. S. 1,393,738. Oct. 18, 1921. The method of operating a cement kiln plant comprising plurality of rotary cement kilns, a waste heat boiler section and a flue into which the individual kilns open at points at varying distances from the boiler section, and which connects the series of kilns to the boiler section which consists in throttling the connection between each kiln and the flue to such an extent as to make the pressure drop or draft consumption between each kiln and the flue greater than the total pressure drop or draft consumption in the flue and maintaining such draft conditions throughout the connected parts of the system as will compensate for the resistance created by the throttling of the connections and bring about a sufficient and an approx. even draft in the kilns. C. M. S., Jr.

142. Waterproofing composition for cement or similar materials. H. C. Badger. U. S. 1,396,546, Nov. 8. A mixt. adapted for waterproofing concrete is formed of clay satd. with Na silicate and dried and burnt clay satd. with $CaCl_2$ and dried. Cement 95–75% is used with 5–25% of the mixed treated silicates and a small amt. of $MgSO_4$ or $CaSO_4$. (*C. A.*)

143. Waterproofing natural stone. F. P. Jackson. U. S. 1,396,118. Nov. 8. Natural stone such as Ohio blue sandstone is freed from moisture by heating and is then impregnated with a hot mixt. of linseed oil 60, paraffin 3 and paraffin oil 40 parts in order to prep. it for use as elec. insulation or for building purposes. Coloring substances also may be used. (*C. A.*)

144. Cements, mortars, etc. K. Winkler. Brit. 167,138. Feb. 1, 1921. Cements, mortars, concretes, etc., are rendered waterproof, adhesive, and quick-setting by being gaged with a metallic chloride soln., such as $CaCl_2$ soln. of 23° Bé., or by the addition of an equiv. amt. of solid chloride to the dry cement. Preferably from 1/4–3% of $Ca(NO_3)_2$, $Sr(NO_3)_2$, $Mg(NO_3)_2$, MnO_2, MnO, BaO_2, chromic oxide, Sb_2O_3, butter of Sb, $Mn(BO_2)_2$ or sugar, or a mixt. of these substances is also added to the cement. The action of the metallic chloride is further intensified if 2–7% of coal cinders, calc-spar, feldspar, bauxite, heavy spar, or fluorspar is incorporated with it during its manuf. from the corresponding carbonate or oxide. (*C. A.*)

145. Artificial stone. A. J. Sanders. Brit. 166,307. March 12, 1920. Recently formed artificial stone, composed of portland-cement mortar or asbestos-cement mortar, is impregnated in succession with solns. of 2 or more metallic salts, which react with one another and with the sol. component of the stone to form a colored ppt. Suitable salts are Pb acetate followed by Na_2CrO_4 or $K_4Fe(CN)_6$ followed by $CuCl_2$. (*C. A.*)

146. Cements. H. WADE. Brit. 169,807. July 5, 1920. A cement mixt. for use in concretes resisting the action of sea water or sulfated water comprises cement of the kind described in 170,063 with the addn. of finely ground pozzuolana, trass, basic slag, or the like in quantities sufficient to absorb the lime liberated during the setting of the concrete. (*C. A.*)

147. Cements. H. WADE. Brit. 169,808. July 5, 1920. Cements are made by calcining mixts. of limestone and leucite, both free from Fe, to which small quantities of metallic oxides are added for coloring purposes. The potash of the leucite is recovered from the kiln gases by condensation and settling in a dust chamber. (*C. A.*)

JOURNAL AMERICAN CERAMIC SOCIETY

Preparation of Abstracts

Every article in THIS JOURNAL is to be preceded by an abstract prepared by the author and submitted by him with the manuscript. The abstract is intended to serve as an aid to the reader by furnishing an index and brief summary or preliminary survey of the contents of the article; it should be suitable for reprinting in an abstract journal so as to make a reabstracting of the article unnecessary. The abstract should, therefore, **summarize all new information completely and precisely.** Furthermore, in order to enable a reader to tell at a glance what the article is about and to enable an efficient index of its subject matter to be readily prepared, the abstract should contain **a set of subtitles** which together form a **complete and precise** index of the information contained in the article. This requires at least one and often several subtitles even for a short abstract.

In the preparation of abstracts, authors should be guided by the following rules, which are illustrated by the abstracts in THIS JOURNAL for February and March, 1921.* The **new information** contained in an article should first be determined by a careful analysis; then the subtitles should be formulated; and finally the text should be written and checked.

Rules

1. **Material not new** need not be analyzed or described in detail; a valuable summary of a previous work, however, should be noted with a statement indicating its nature and scope.

2. **The subtitles should together include all the new information;** that is every measurement, observation, method, improvement, suggestion and theory which is presented by the author as new and of value in itself.

3. **Each subtitle should describe the corresponding information so precisely** that the chance of any investigator being misled into thinking the article contains the particular information he desires when it does not, or vice-versa, may be small Such a title as "A note on blue glass," for example, is evidently too indefinite a description of information regarding "Absorption spectra of glass containing various amounts of copper-cobalt and chromium-cobalt." General subtitles, such as "Purpose" and ' Results" should not be employed as they do not help to describe the specific information given in the article.

4. **The text should summarize the authors' conclusions and should transcribe numerical results of general interest,** including those that might be looked for in a table of physical and chemical constants, with an indication of the accuracy of each. It should give all the information that anyone, not a specialist in the particular field involved, might care to have in his note book.

5. **The text should be divided into as many paragraphs as** there are distinct subjects concerning which information is given, but no more than necessary. All parts of subtitles may be scattered through the text but the subject of each paragraph, however short, must be indicated at the beginning.

6. **Complete sentences** should be used except in the case of subtitles. The abstract should be made as readable as the necessary brevity will permit.

7. The ms. of all abstracts must be typewritten and double or triple spaced.

* The rules were prepared by the Research Information Service of the National Research Council. The Society is indebted to Dr. G. S. Fulcher of the Corning Glass Works (formerly with the National Research Council) for the rules and the illustrative abstracts.

CERAMIC ABSTRACTS

Compiled by the

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General and Miscellaneous

1. Graphical treatment of stack gas analysis and fuel gas analysis. W. TRINKS. *Blast Furnace & Steel Plant*, **10**, 50–58(1922).—Charts calcd. for stack gas analysis, natural gas, by-product tar, coke-oven gas and for coal gas are based upon Walter Ostwald's "*Beitrage zur graphischen Feurungstechnik*" and upon similar papers which have appeared in German scientific journals. (Cf. *C. A.*, **14**, 257, 484, 490, 2414, 3552, 3569.) W. T. HALL (*C. A.*)

2. Pulverizing anthracite coal. HARLOWE HARDINGE. *Elec. World*, **79**, 433(1922).—Anthracite culm with an ash content of 25 to 30%, considered to be the hardest anthracite in the eastern U. S., was ground in a mill so as to allow 90% to pass a 200-mesh screen. The power required for grinding amounted to 30 h. p. hrs. per ton of coal. A softer coal with 18% ash required a total of 20 h. p. hrs. per ton ground to 200-mesh, 90%. C. G. F. (*C. A.*)

3. Heat utilization and economy in steam power plants. W. GRAULICH. *Chem.-Ztg.*, **45**, 1233–38(1921).—An elementary presentation of the principles of combustion, and heat utilization in boilers and engines, intended primarily to assist owners and operators of small power plants in effecting economies by the use of modern devices and methods. Numerical problems on heating value of fuel, boiler and engine efficiency, satd. and superheated steam, waste steam and flue gas utilization, are given in detail. W. C. EBAUGH (*C. A.*)

4. The "Gee-system," a new procedure for the separation of solid materials from liquids. C. R. PLATZMANN. *Z. angew. Chem.*, **34**, Aufsatzteil, 623–35(1921).—This filtering system is a simple combination of the filter press and the centrifuge. Its advantages are: (1) const. flow coeff., (2) rapid filtration, (3) small space requirement, (4) no clogging up of the filter surfaces, (5) little wear on the filter cloths, (6) simple tending, (7) sepn. of the filtered out solids according to size of particles, (8) possibility of using high pressure, and (9) ease of assembling and taking apart. The construction and operation of the system are fully described with the aid of three drawings. The especial advantages of this system in the *elutriation of the porcelain clays* are: (1) it reduces the cost more than half, (2) it produces a much finer-grained product than was previously possible, (3) it gives a product of highest quality regardless of the phys. condition of the clay as mined, (4) the finest particles are recovered from the filtrate, and (5) the moisture content of the sepd. clays is lower than heretofore. Other applications in *ceramics* and in the *dye, paper, coal, brewing, malting and distilling industries* are pointed out. The system is in use in the kaolin industry in Cornwallis, England. C. C. VAN VOORHIS (*C. A.*)

5. Modernize coke-oven plants. J. M. HASTINGS, JR. *Iron Trade Rev.*, **70**, 262–66; *Blast Furnace & Steel Plant*, **10**, 12–17(1922).—The Rosedale and Franklin plants of the Cambria Steel Co. at Johnstown, Pa. constructed by the Semet-Solvay Co. are described. J. L. WILEY (*C. A.*)

6. Apply powdered coal to air furnace. P. DWYER. *Foundry*, **49**, 955–62(1921).—Malleable-Fe melting furnaces and annealing ovens have been converted from hand-firing to powdered coal firing without radical changes in design. At the Marion (Ind.)

Malleable Iron Works the annealing ovens can now be raised to the required temp. of 870° in 18 hr., where hand-firing took 72 hr. The powdered coal installation is described in detail. A. Butts (*C. A.*)

7. Contributions to the history of chemical arts. F. Rathgen. *Chem.-Ztg.*, **45**, 1101–2(1921); 1 cut.—Descriptions and chem. analyses are given of (1) a Babylonian glass vase; (2) an antique Babylonian glass slab; (3) a silver ring from El-Armana; and (4) a sample of wool from a sarcophagus of the time of Alexander the Great, in which indigo was present as the coloring substance. T. F. Buehrer (*C. A.*)

8. The utilization of liquid fuels in Hoffmann kilns. L. Mascard. *Bull. soc. encour.*, **133**, 1192–95(1921).—The scarcity and expensiveness of coal in Oran (Algeria) led to the adoption of liquid fuels mixed with solid combustibles for firing Hoffmann kilns. The following methods are described: (1) Heavy petroleum fuel oils fed intermittently and by a continuous automatic process. (2) Mixts. of powdered coal and oil. (3) Mixts. of ground and screened coal cinders and smoke-box refuse with gas tar. This latter method was the most economical. In it combustion is less vigorous than with fuel oil, the fire is more easily regulated and more const.; this produces a red color in the bricks and tiles more easily. Greater fluidity of the gas tar enables the fuel to be handled easier. Better admixtures of the solid with the liquid fuel are maintained. Little or no soot is formed, and after 17 months' continuous operation less than 300 kg. was deposited. A. R. Albouze (*C. A.*)

9. Kinetic and static coagulation measurements with suspensions. F.-V. v. Hahn. *Z. Elektrochem.*, **27**, 501–5(1921); cf. *C. A.*, **16**, 516.—The distinguishing characteristics of the different disperse systems are tabulated and discussed. Whether a sol belongs to the mol. system or not can be detd. by ascertaining whether it undergoes coagulation or flocculation. A kinetic method for coagulation measurements with suspensions is described. This method depends on weighing the sedimented suspensoid or detg. the d. of the dispersion medium over the sediment. Graphic representation of the results of coagulation measurements by this method shows that they agree with those obtained by the static method. H. Jermain Creighton (*C. A.*)

10. Fuel economy. Excess air as a cause of waste. S. N. Duguid. *Iron and Coal Trades Rev.*, **104**, 75–6(1922).—The principal losses in a boiler plant are estd. as follows: loss by handling 1%, in ash 3.9, radiation 2.9, incomplete combustion 0.7, excess air 19.6, faulty baffles 1.1, soot 3.8, scale 5.0, incorrect correlation of load and draft 3.8. D. shows how the loss due to excess air can be reduced and how efficiency can be increased by use of gas analyzers and CO_2 recorders. J. L. Wiley (*C. A.*)

11. Use of medium-grade gases in the steel industry. F. J. Denk. *Blast Furnace & Steel Plant*, **9**, 719–21(1921).—Natural gas, even with its high heating value, is not the best available gas to use in steel plant heating. The efficiency of a gas does not depend upon its heating value, but upon the flame temp., the amt. of air required for combustion, the sp. heat of the waste gases, and their quantity. For the above reasons coke-oven gas or Elliott gas, a combination coal and water gas made in the Elliott producer, is more efficient. The amt. of the latter made from 1 ton of coal varies between 57,000 and 63,000 cu. ft. with a heating value of 465 and 415 B.t.u. and the same sp. gr. as coke-oven gas. Comparative tests on open-hearth furnaces fired with producer gas of 143 B.t.u. and with coke-oven gas of 408 B.t.u. gave the following results: with the former 1 long ton of steel required 661.5 lb. of coal but only 11,477 cu. ft. of coke-oven gas; assuming a producer efficiency of 89%, the heat equiv. of the 2 fuels was 1414 B.t.u. for the former and 1000 for the latter, while the daily output was, resp., 39 and 49 tons. The av. life of a 30-ton furnace with coke-oven gas was 3.5 month with 10725 tons of steel, with producer gas 2.5 months and 8016 tons of steel. In a 100-ton furnace the respective tonnages per charge were 97.3 and 96.5 tons. In a 12-ton furnace

the respective daily production was 48 and 39 tons, the av. consumption of coke-oven gas being 9888 cu. ft. per ton. The advantages of using coke-oven or Elliott gas are: increased production, simplification in furnace construction, lower repair, initial and operating costs, and easier working of the charge. By applying Steck's formula for calcg. the relative value of the different gases, coke-oven gas is found to be 1.85 times and Elliott gas 2.21 times more efficient than producer gas. J. L. WILEY (*C. A.*)

12. A new incandescent burner for kerosene and heavy hydrocarbons. P. WAGUET. *Rev. prod. chim.*, **24**, 779–80(1921).—The fuel passes from the reservoir, through a wool filter and needle valve, into a pipe which rises close to the mantle, into a coil over the top of the mantle, then through a descending tube terminating in a fine opening, and finally through a tube like that of a Bunsen burner, which is curved to bring the vapors under the grating. To light the burner the reservoir is put under a pressure of about 1.5–2 kg. (about 20–27 lb. per in.^{2}) and a little alc. is burned to heat up the fuel in the tube beside the mantle and vaporize it. Various types of this burner have been designed for service under special conditions. For heating purposes the mantle is dispensed with, and the flame is that of a regular Bunsen. It is cheaper and safer than gasoline or compressed C_2H_2 burners. A. P.-C. (*C. A.*)

13. Gaseous firing for industrial purposes. F. J. BOSTOCK. *Gas. J.*, **156**, 882–84; *Gas World*, **75**, 573–5(1921).—For general purposes, the most economical method of using solid fuel is to subject it to destructive distn. The advantages of this are discussed. B. compares the methods of gaseous firing by low pressure, high pressure gas and air blast, and gas and air mixt. The latter method is the most practical soln. to the problem of gaseous firing. A special type of gas and air incorporator made in accordance with the Docking patents is described. It is capable of being automatically adjusted according to the quality of the gas and the temp. desired. Its application is broad and furthers economy in operation. The cost of gas for metal melting is compared to that of electricity. J. L. W. (*C. A.*)

14. Bentonite. R. B. LADOO. Bur. of Mines, *Repts. of Invest.*, No. **2289**, 5 pp.(1921). —Bentonite is a clay-like group of materials of rather indefinite compn. characterized by an easily replaceable alk. and alk. earth content of 5 to 10%, fine grain size, high absorptive power and colloidal properties. H_2O contg. $CaSO_4$ can be softened by passing through especially treated bentonite. It is utilized in the manuf. of *antiphlogistine* and other medical prepns.; as a retarder in the manuf. of gypsum wall plaster; as a *soap filler* as *paper filler* and as a *candy adulterant*. Its use in soap is not adulteration for it actually increases the lathering and detergent properties. Eight analyses of samples from different sources show ranges in compn. as follows: SiO_2 54.00 to 63.20, Al_2O_3 11.84 to 26.58, Fe_2O_3 2.46 to 3.97, CaO 0.59 to 4.94, MgO 1.01 to 3.24, K_2O 0.00 to 2.34 and Na_2O 0.66 to 4.33. D. B. DILL (*C. A.*)

15. Powdered fuel. J. S. ATKINSON. *Iron and Coal Trades Rev.*, **103**, 802(1921).—A description is given of a self-contained unit, called the *Turbo pulverizer*, which drys, pulverizes and feeds the coal to the furnace with the proper amt. of air for combustion. The installation has proved satisfactory, both with regard to furnace temp. and conditions, and to coal economy. In connection with a forge furnace the av. coal consumption for 6 mo. was 176 lb. per ton of metal; with a tube-heating furnace over 9 months, 4 cwt. per hr. for each 30 cwt. of metal. The av. cost for 300 days of coal pulverizing with a 1-ton per hr. installation was 2 s. 10 d. **The Turbo pulverizer** ANON. *Ibid.*, 877.—A description with diagram. J. L. WILEY (*C. A.*)

16. Pulverized coal as fuel. E. B. POWELL. *Elec. World*, **79**, 273–4(1922).—A brief survey. The utilization of waste fuels is emphasized. C. G. F. (*C. A.*)

17. Coal and coke mixtures as water-gas generator fuel. W. W. ODELL. Bur. of Mines, *Tech. Paper*, No. **284**, 32 pp.(1921); cf. *C. A.*, **15**, 1204.—Information is given

bearing on the effect of a stand-over period on capacity and possibilities in the use of the blow-run method of operating with mixed fuels, coal and coke. Data are included on the behavior of the various fuels used, the clinker conditions, the use of fuel high in ash and S. It was found that a decided benefit is realized when operating with a long lay-over period. When operating but a small part of the day, up to 8 hr., the capacity of the plant can be maintained in using 100% coal, but with the same vol. of air per min. per sq. ft. of grate area, the make per sq. ft. of grate per run hr. decreases markedly after that time until the hourly make is less than the normal make with coke. All bituminous coals do not behave the same and the method of operating should be worked out for each coal in order to obtain the best results. The size of fuel used is of importance and should be given more attention when using coal than when coke or mixed fuel. With coal blowholes form more often than with coke, especially when the coal is composed chiefly of large lumps and some slack. With mixed coal and coke no trouble appears unless the coal is in greater amts. than 60% by wt.; as % of coal increases the difficulty increases especially with high blast pressures and when no fuel spreader is used. The symptoms, cause and remedy for blowholes are discussed. The relative value of the air purge using coal, coke, and mixts. of each is shown and gas analyses are given. More benefit is to be derived from an air purge with coal fuel, or with coal and coke mixts., than with coke as the % of CH_4 and illuminants increase during the run and to a considerable extent neutralize the effect of the increasing % of CO_2. With mixed fuel, coal and coke: the tendency for caking and arching of the fuel in the generator is *nil* unless a high % of coal is used; the clinker troubles are not necessarily over those prevailing with coke alone; the fuel per M with blow-run operation is appreciably less than with 100% coal and the oil consumption is no higher; the capacity with blow-run operation is greater than can be obtained with 100% coal and may equal or surpass that with 100% coke; a more uniform gas standard can be obtained; trouble is less from tar emulsions, the tar settles out to about 1% H_2O; boiler fuel per M is no greater than with 100% coke. J. L. Wiley (*C. A.*)

18. Some critical observations on the generation of producer gas. J. Gwosdz. *Brennstoff Chem.*, **2**, 345–6(1921); See *C. A.*, **15**, 3549.—Review of proposals to produce low-N gas by means of external heating. W. B. V. (*C. A.*)

19. Lean coals tested in gas producer. J. Blizard and E. S. Malloch. Can. Dept. Mines, *Bull.* **33**; *Gas Age Record*, **49**, 135–6(1922).—An abstract of the results obtained with 25 Canadian lignites in a Westinghouse, double-zone, suction-gas producer. About ½ of the fuels tested can be recommended for continuous operation in this type of producer. The gas produced ranged from 51 to 106 cu. ft. per lb. of fuel, and from 75 to 120 B.t.u. The net B.t.u. efficiency ranged from 40 to 94.

J. L. Wiley (*C. A.*)

20. Continuous water-gas producer. A. W. H. Griepe. *Am. Gas. J.*, **116**, 53–4 (1922).—The advantages over the intermittent type are: continuous flow and uniform quality of gas, clean gas and reduction in operating cost. The operation is as follows: In a producer shell is placed a hot plate heated by external gas burners. Steam from nozzles forces the powdered fuel and steam onto the hot plate, igniting the C and decomposing the steam into H_2 and O_2. Any grade of powdered coal can be used. The coal and steam are kept in the ratio of 2 to 3. The net amt. of gas produced from 1 lb. of C and 1.5 lb. of steam is 45 cu. ft. (18 cu. ft. are used for heating the plate). The gas compn. is: H_2 48.53%, Co 50.2, CH_4 0.785, O_2 0.015, CO_2 0.47, and 300 B.t.u. assuming 75% efficiency of the app. The cost per 1000 cu. ft. with coal at $5.50 per ton and water $1.00 per gal. is 12 cents. J. L. W. (*C. A.*)

21. Cleaning producer gas made from bituminous coal. H. W. Seldon. *Blast Furnace & Steel Plant*, **9**, 708–10(1921).—There is neither evidence nor sufficient reason

for cleaning producer gas except where it is absolutely necessary before the gas can be used for gas engine fuel or where the point of consumption is so far removed from the producer that deposits in the main cause trouble. All the known methods for cleaning sacrifice the sensible heat of the gas in addition to the B.t.u. value of the tar and volatile hydrocarbons. The combined loss is probably in excess of 20% of the heating value of the coal. It is calcd. that the sensible heat loss in cooling the gas to atm. temp. is equal to 11.6%. Thus it would be too costly from a fuel standpoint besides resulting in a gas unsuitable for the open-hearth furnace. J. L. WILEY (*C. A.*)

22. Using clean cold producer gas. C. F. KAUFMAN. *Iron Trade Rev.*, **70**, 267–70 (1922).—K. traces the development of the Smith glass-wool tar extractor and its use in connection with the Smith up-draft type of producer using bituminous coal or lignite as the fuel. The tar extractor consists of a mat of spun glass held firmly between 2 perforated plates and located in the gas line beyond the producer. A pressure of 2–3 lb. per sq. in. is necessary. It functions by collecting the tar fog into drops which are too heavy to be carried along by the gas stream and therefore are condensed and drain off. It has a cleaning efficiency of over 99.5%. It requires less power than mech. scrubbers, is much more efficient, and H_2O is not used in its operation, consequently no emulsions are formed, and the tar and H_2O in the gas can be sepd., the tar being returned to the producer for gasification. It is shown that illuminants in gas are not essential to furnace efficiency; therefore, the removal of them and the return of the tar to the producer to be gasified does away with the objection that the loss of B.t.u. value is detrimental to the heating quality of the gas and to efficient furnace operation. By this method the gas gains in quality owing to the increase in the H–CH_4 ratio and the CO content. Clean cold producer gas contains also a smaller amt. of S. The sensible heat is not wasted by cooling and cleaning the gas but is removed in the gas plant and taken up again in the regenerators in the furnace with a lowering of the stack temp. (Cf. Seldon, preceding abstract.) J. L. WILEY (*C. A.*)

PATENTS

23. Gas manufacture. KOPPERS CO. Brit. 170,572, Oct. 6, 1921. Fuel gases, such as coke-oven gases, are purified from CO_2 and H_2S by being passed through a pipe into scrubbers contg. Na_2CO_3, the gas then passing by a pipe to Fe oxide purifiers for the absorption of any traces of H_2S remaining. The foul soln. is passed from the scrubbers by a pipe through a heater to a hot well and is raised by a pump to the top of a cooling tower in which the H_2S, CO_2 and CN compds. are driven out by a current of air or inert gas, and the revivified soln. from a basin is returned by a pump and pipe to the scrubbers. A portion of the soln. from the basin is passed by a pump to primary gas coolers, being thereby heated, and is returned by a pipe to the hot well to raise the temp. therein. A suitable construction is specified. (*C. A.*)

24. Heat insulation. E. T. HOLMBERG. U. S. 1,404,438, Jan. 24. A heat-insulating material adapted for use in metal cabinets is formed by moistening a mixt. of MgO 30 and infusorial siliceous earth 70% with a satd. soln. of $MgCl_2$ and compressing the mixt. in a mold. (*C. A.*)

25. Separating feldspar and quartz (hydraulic concentration). F. P. KNIGHT AND J. T. SHIMMIN. U. S. 1,404,974, Jan. 31. (*C. A.*)

26. Artificial meerschaum. P. DEUSSING. Brit. 172,004, Nov. 18, 1921. Addition to 164,319 (*Ceram. Abs.*, **5**, 59(1922)). The artificial meerschaum described in the principal patent, and consisting substantially of Hallic earth or roasted Meissner clay, raw Meissner clay, whiting, and quartz dust, is improved by the addition of kieselguhr to the ingredients or by substituting kieselguhr for the quartz dust. The compn. is molded, roasted, and finished in the manner described in the principal patent. (*C. A.*)

27. Filtering and oil-decolorizing earth. R. G. Tellier. U. S. 1,402,112, Jan. 3. A filtering and oil-decolorizing material is prepd. by baking and oxidizing fuller's earth while agitated in an air current at a temp. of about 400–700°. (*C. A.*)

28. Heat-insulating material. H. S. Ashenhurst. U. S. 1,402,133, Jan. 3. An insulating material of light wt. is formed of $Al_2(SO_4)_3$, $MgCO_3$, gypsum and H_2O, with or without fiber, and a retarder. (*C. A.*)

29. Manufacture of carbon arc electrodes. W. Mathiesen. G. P. 341,240, 31.7.20. Carbon prior to the burning process is subjected to pressure considerably higher than that employed in the moulding process. Such carbons used in the arc afford a higher crater temperature and greater light emission.

J. S. G. T. (*Jour. Chem. Ind.*)

Apparatus and Instruments

30. Electric carbon dioxide recording instrument. M. Moeller. *Siemens Z.*, Dec., 1921; *Elec. World*, **79**, 293(1922).—The temp. of an elec. heated resistance wire will depend upon the heat cond. of the gas surrounding this wire. The heat cond. of CO_2 is about 40% less than that of all the other gases contained in the flues of boilers. Consequently the temp. of the wire will be proportioned to the percentage of CO_2 contained in the flue gases. By using 2 wires, one operating in the flue gas and the other in air their temp. difference is detd. by their proportional ohmic difference. An instrument indicating directly CO_2% is used in parallel with a galvanometer. Fine Pt wires are used which change their resistance about 3.5% for each 10° temp. rise.

C. G. F. (*C. A.*)

31. A new comparison apparatus for colorimetric determination. O. Mannebach. *Chem.-Ztg.*, **46**, 20(1922).—The comparison tubes stand obliquely in a beaker of H_2O which is placed in a wooden box, black inside, open at the top, and with a round hole slightly smaller than the bottom of the beaker cut in the bottom. Under the box is a reflector which throws a suitable light up through the beaker, enabling a comparison of the most delicate tints. J. H. Moore (*C. A.*)

32. A new radiation pyrometer. Anon. *Chem.-Ztg.*, **46**, 20–1(1922); 2 cuts.—The app. resembles a small telescope and may be used in the hand or on a tripod. The object or part of the furnace to be tested is brought sharply into the field of vision, the heat rays being at the same time automatically focused on the thermoelement which is seen in the field. The temp. is read on a scale just over the eye-piece. The app. may also be attached to a recorder, is accurate within 10–15° at 1000°, may be constructed with scales from 500–2000°, and, above 1 m., is independent of the distance of the object so long as the image of the latter in the field completely covers the thermoelement.

J. H. Moore (*C. A.*)

PATENTS

33. Apparatus for electrical precipitation of suspended particles from gases. L. Bradley. U. S. 1,400,795, Dec. 20. (*C. A.*)

34. Gas calorimeters. W. B. Davison. Brit. 171,246, Sept. 13, 1920. The products of combustion are brought into intimate association with a cooling liquid by passing both the products and the liquid through a common divided medium. (*C. A.*)

35. Viscosimeters. R. L. Frink. Brit. 171,774, Aug. 20, 1920. The app. is particularly intended for measuring the viscosity of highly viscous materials, such as molten glass, and comprizes an angularly displaceable or rotatable member contacting with the material and means for measuring the speed of rotation of this member produced by a const. torque, or the torque required to produce a const. angular velocity. (*C. A.*)

36. Centrifugal separator. F. H. Lindenberg. U. S. P. 1,395,193, 25.10.21. Appl., 8.3.17. A perforated conical basket with the wider end uppermost is adapted

to revolve about a vertical axis and is mounted for universal rotation about a centre in the axis. Spiral vanes within the basket are arranged to revolve differentially in the same direction as the basket to control the upward movement of material upon the surface of the basket. The basket and the vanes are revolved at speeds bearing a definite ratio by means acting in the transverse plane of the centre of rotation.

H. H. (*Jour. Chem. Ind.*)

37. **Vacuum filtration apparatus.** A. T. Cartner, R. Clewer, and Mather and Platt, Ltd. E. P. 170,788, 21.1.21. A liquor trap is provided between the receiver and air pump of a vacuum filtration apparatus. The inlet pipe from the receiver extends nearly to the bottom of the trap and the outlet pipe to the pump terminates near the top and is provided with a valve seat adapted to be closed by a floating ball. Another valve operated by a float is adapted to admit air to break the vacuum in the event of the liquor rising too high. Perforated diaphragms are also provided within the trap on which may be placed an absorbent for any corrosive gases given off by the filtered liquor. B. M. V. (*Jour. Chem. Ind.*)

38. **Filling material for use in Glover towers and similar apparatus.** P. Kestner. E. P. 170,982, 18.8.20. Addn. to 131,502 (J., 1919, 746A). The rings of ceramic material are made by stamping them in the form of truncated cones from a layer of ceramic paste by means of cutting punches. J. S. G. T. (*Jour. Chem. Ind.*)

Chemistry, Physics and Geology

39. **Vapor pressure of some salts. II.** H v. Wartenberg and H. Schulze. *Z. Elektrochem.*, **27**, 568–73(1921); cf. *C. A.*, **15**, 2376.—Measurements have been made of the vapor pressures of LiCl, CsCl, RbCl, LiBr, CsBr, RbBr, NaF, KF, LiF, CsF, RbF, NaI, CsI and RbI at a no. of temps. between the b. p. of the salt and 200–300° below the b. p. The vapor-pressure curves of the different fluorides are widely separated from one another; those of the other classes of salts lie closer together the higher the at. wt. of the halogen. H. Jermain Creighton (*C. A.*)

40. **Some conclusions in regard to the origin of gypsum.** F. A. Wilder. *Bull. Geol. Soc. Am.*, **32**, 385–94(1921).—Gypsum deposits contg. less than 0.05% of $CaCO_3$ cannot have formed by the evapn. of sea water or of stream-fed inland basins. Circulating water which has dissolved disseminated gypsum is a primary factor in the formation of recent gypsum deposits. These deposits are further augmented by wind action and evapn. in inland lakes. The alteration of carbonate rocks or anhydrite may also explain some gypsum formations. W. F. Hunt (*C. A.*)

41. **Recent advances in science—Mineralogy and crystallography.** A. Scott. *Sci. Progress*, **16**, 374–77(1922).—Review of recent work in chem. crystallography.

J. S. H. (*C. A.*)

42. **Metasomatism in siliceous rocks.** V. M. Goldschmidt. *Geol. För. Förh.*, **43**, 463–8(1921).—An advance summary. W. Segerblom (*C. A.*)

43. **Notes on sodium silicate.** A. Erdenbrecher. *Mikrokosmos*, **15**, 55–60(1921).—The no. of mols. of H_2O which crystallize with Na_2SiO_3 depends on the compn. of the mother liquor. When 20–25 g. $Na_2SiO_3.9$–$10H_2O$ are dissolved in 40 cc. H_2O, the addn. of not more than 40 g. NaOH per 100 cc. of soln. yields $Na_2SiO_3.9H_2O$, rhombic, m. 47°; of 60 g. NaOH yields $Na_2SiO_3.6H_2O$, monoclinic, m. 63.5°; and of larger amts. of alkali yield $Na_2SiO_3.4H_2O$, hexagonal, m. 83–85°. Other hydrates of the metasilicate mentioned in the literature are probably mixts. of these as changes in the compn. of the mother liquor cause the crystals to change their degree of hydration. Excellent photographs of the various hydrates and their transformations are given.

W. S. (*C. A.*)

44. Electrical dust precipitation and gas purification (Cottrell process). L. Plasz. *Metall. u. Erz.*, **18**, 539–47(1921).—The efficiency of com. pptg. app. varies from 86% on carbide furnaces to 99.99% on brown-coal combustion gases. The app. works without difficulty at 550°. About 50 plants are working in Germany and 200 elsewhere including about 100 in the U. S. Details of construction and operation are given.

R. S. D. (*C. A.*)

45. The determination of density and the methods of expressing it. F. Bordas and F. Touplain. *Bull. soc. encour.*, **133**, 1052–74(1921).—B. and T. discuss the various methods of expressing d. and the various methods of detg. it. They make a plea for a more definite statement of the method and conditions under which detns. are carried out, show the errors inherent in each method and the corrections to be applied in each case to get the abs. $d\frac{t^\circ}{4^\circ}$ *in vacuo* from the results obtained directly, and advise the use of the sp. gr. balance in preference to hydrometers, applying the necessary corrections, as otherwise the figures obtained are quite arbitrary. For purely scientific work the abs. d. *in vacuo* should be used to the exclusion of all others.

A. P.-C. (*C. A.*)

46. Diffusion in porous vessels. A. L. Herrera. *Mem. rev. soc. cient. "Antonio Alzate,"* **39**, 343–47(1921).—When solns. of reactive salts are allowed to diffuse very slowly together, the ppts. or crystals formed show analogies to natural cells. A soln. of K silicate, d. 1.5 or more, contg. K_2CO_3 not in excess of *N*, is placed inside an unglazed porcelain cup, and the latter placed in $CaCl_2$ soln. of 1° Bé. After 24 hrs. numerous very fine tubes of Ca silicate are formed on the outside of the porous cup, which bear on their surface microscopic cells, and in some cases are formed entirely of the latter.

M. R. S. (*C. A.*)

47. Liesegang ring formation. H. A. McGuigan. *Science*, **55**, 100–1(1922); cf. *C. A.*, **15**, 3011.—Polemic with Bradford, *C. A.*, **16**, 518. F. L. Browne (*C. A.*)

48. General colloid chemistry. IV. The physical-chemical analysis of aluminium oxy salts and aluminium oxide sols. Mona Adolf and Wolfgang Pauli. *Kolloid-Z.* **29**, 281–87(1921).—Heating an excess of thoroughly washed $Al(OH)_3$ for a day with HCl gave a sol characterized by its inability to pass through parchment paper and by the fact that a small amt. of electrolyte coagulated it. The limiting value for the compn. of the sol was $[Al(OH)_3]_2.AlOCl$ and this value could be exceeded very little. By regulating the amt. of acid the pure oxy salts $Al(OH)Cl_2$ or AlOCl could be easily prepd. Neither a mixture nor an intermediate oxy salt between these two was obtained. By comparison with the mol. cond. of salts such as NaCl, $BaCl_2$ and $AlCl_3$, $Al(OH)Cl_2$ was shown to form three ions. The degree of ionization increased rapidly with diln. The steps by which ionization occurred, from the formation of $Al(OH)Cl^-$ to that of OH^- ions, could be followed by measuring the concn. of free Cl^- and of H^+ ions. The degree of hydrolysis was very small, being 0.25% as compared to 4.5% for $AlCl_3$ at a diln., $V = 1024$. The equiv. cond. for the Al constituent was normal for very dil. solns. but was surprisingly high, 99.7 mhos. at 0.068 *N*, at moderate dilns. This would be true if in addition to the normal ionization of $Al(OH)Cl_2$, complex ionization occurred so that free Cl^- ions would be used up, *e. g.*, $Al(OH)Cl_3|Al(OH)Cl$. Similar ionization has been shown for Zr compds. (cf. *Ceram. Abs.*, **5**, 104(1922)). Further proof of the fact was given by electroendosmosis expts. in a Landsteiner-Pauli app. At moderate dilns. both positive and negative Al constituents were present, while in very dil. solns. only the positive were present. Similar analysis of aluminyl monochloride, $Al(OH)_2Cl$ or AlOCl, proved it to be a two-ion compd. and that complex ionization, such as $Al(OH)_2Cl_2|AlO$, probably occurred. H. M. McLaughlin (*C. A.*)

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49. Alumina. D. Tyler. Brit. 172,087, Aug. 24, 1920. Al ores or Al-contg. materials such as clay, slags, or ashes are mixed with CaO or equiv. Ca or Mg compd. in such quantity that there are at least two mols. of CaO, etc., for every mol. of SiO_2 and in addition at least 1 mol. of CaO, etc., for every mol. of Al_2O_3. Allowance is made for any base that may be present. The materials are finely ground and then calcined; a flux such as fluorspar may be added. The product is treated with a soln. of an alkali salt such as Na_2CO_3 in order to give alkali aluminate and an insol. Ca or Mg salt. The former is then treated for the production of Al_2O_3. The $CaSiO_3$ which is left after the extn. is particularly suitable in *cement* manuf., since it is free from insol. alkali salts. Any potash present in the raw material is rendered sol. and is recovered from the alkali left after the pptn. of the Al_2O_3. Cf. 9662, **1915** (*C. A.*, **11**, 89). (*C. A.*)

50. Alumina and potassium compounds from feldspar or similar material. H. P. Bassett. U. S. 1,404,083, Jan. 17. Feldspar or similar material is heated to redness with Na_2CO_3, Fe_2O_3, lime and Na_2SO_4 or NaCl for 1 hr. and the resulting reaction mixt. is treated with NaOH to form Na aluminate, which may be converted into pure $Al(OH)_3$. (*C. A.*)

51. Zinc oxide. Metallbank und Metallurgische, Akt. Ges. Brit. 170,082, July 9, 1920. $CaSO_4$-contg. Zn ppts. resulting from the treatment of Zn liquors contg. sulfate with CaO are freed substantially from their S content by heating and stirring the ppt. suspended in a soln. containing $ZnCl_2$ and Na or Ca chloride, and calcining the resulting basic $ZnSO_4$ after washing with H_2O to free it from $CaCl_2$, etc. The $ZnCl_2$ should be approx. equiv. to the sulfate present and may be added from external sources or may be prepd. *in situ* by means of the Na or Ca chloride. Alternatively, the process may be carried out during the pptn. of the $CaSO_4$-contg. $Zn(OH)_2$. Dil. milk of lime is slowly added to the Zn liquor heated, *e. g.*, to about 70°, to which has been added Na or Ca chloride. If the liquor has a high sulfate content it may be reduced prior to the above treatment by adding NaCl and crystg. out the resulting Glauber's salt. High concns. of Zn and of neutral salts such as Na and Ca chlorides facilitate the formation of the basic sulfate. (*C. A.*)

52. Electrolysis. C. E. Holland. Brit. 171,670, Sept. 7, 1921. Finely divided coal and other org. matter, such as hydrocarbons suspended in H_2O, are coagulated and pptd. by electrolysis. A suitable app. is specified. (*C. A.*)

53. Concentrating ores. L. A. Wood and Minerals Separation, Ltd. Brit 170,944, July 30, 1920. In a froth-flotation process, products obtained by treating viscous substances such as tars, fuel oil, or tar oil, with emulsifying agents such as caustic alkalies, carbonates, soaps, Na resinate, or mixts. thereof, are used as frothing agents or as a source of or in conjunction with frothing agents. *E. g.*, producer-gas tar may be heated with an aq. soln. of NaOH. Cf. 18,943, **1910** and 5454, **1915** (*C. A.* **10**, 2461) and *C. A.* **16**, 233. (*C. A.*)

Refractories and Furnaces

54. The illumination of the interior of kilns. Anon. *Taschen buch für Keramiker Keram. Rundschau*, **1922**, 41–42.—The illumination of the interior of pottery kilns during the setting and removing of the ware is a problem for manufacturers not equipped with elec. Kerosene lamps are dangerous since the kilns are emptied while still hot which may cause an explosion of the lamp. Rape-seed oil lamps have the advantage over kerosene in that they do not explode but these lamps give off an offensive odor when used in hot kilns which make them undesirable. Acetylene lamps have been found to be the best for this purpose since they do not explode or give off an offensive odor. H. G. Schurecht

55. Hot-blast stove rating. F. H. Wilcox. *Blast Furnace Steel Plant*, **10**, 29–32 (1922).—Stoves should be able to carry 1250° straight line heat, with a margin of heat reserve. It is good practice to burden the furnace to the max. degree on as high a blast temp. as it is possible to hold and maintain a heat reserve for emergencies. Coke consumption depends on the heating capacity of the stoves. The influence of five different checker sizes and of 3 and 4 stove combinations are shown for a 600-ton furnace. Brick of 1″ in depth functions efficiently in heat input and output. 400° is the practical limit for drop of temp. in stove brickwork. The load in a stove because of alternate heating and cooling is a "live load." Failures may come from springdown of tile arches and piers, shifting of checkers, expansion of ring walls and checkers or failure of dome. Operating troubles may be fluttering or surging, inefficient use of all of the checker area and insufficient draft due to small chimney valves, draft chambers and stacks. The most efficient dimensions of brick and checkers and the no. of stoves are discussed.

Jas. O. Handy (*C. A.*)

56. An electrically heated forging and heat-treating furnace. G. M. Little. *Trans. Am. Soc. Steel Treating*, **2**, 228–36(1921).—An account of the development of a resistance type elec. furnace for high temp. work. By surrounding a heating element of C plates, clamped together, with a blanket of hydrocarbon vapors, greater crowding is possible, thus permitting the production of a larger amount of heated metal. The heating element is suspended across the furnace chamber free from the walls or roof; the top lining to the furnace chamber is composed of bars of C covered with a thick layer of coke dust. The roof can not be melted and is protected from oxidation by the same blanket of hydrocarbon vapors which protects the heating element. Some data on the performance and cost of operation are given.

W. A. Mudge (*C. A.*)

57. Refractories and their application to gas works and coke ovens. P. G. Strassmann. *Gas u. Wasserfach*, **64**, 777–81, 798–801, 811–18(1921).—The clay and quartzite resources of Germany, their properties, and manuf. into refractories are discussed.

J. L. Wiley (*C. A.*)

58. The electric furnace in melting and refining. J. B. C. Kershaw. *Electrician*, **87**, 636–39(1921).—A review of the status of the elec. furnace in the English Fe and steel industry during 1921. The tendency in design has been to increase the power of the transformers rather than to follow the German and American tendency to increase the size of the furnace. The Héroult and the Electrometals are the furnaces most in favor.

Louis Jordan (*C. A.*)

59. Expansion of some refractory materials at high temperatures. B. Bogitch. *Compt. rend.*, **173**, 1358–60(1921).—Expansion curves for bricks of fused bauxite, clay, silica, chromite, and magnesia over the temperature range 0° to 1600°C are given. The smallest expansion is shown by the fused bauxite, which is suitable for the construction of furnaces subject to sudden changes in temperature. Silica bricks showed the most irregular expansion. They expanded rapidly up to 600°C and then only very slowly, and above 1000°C showed a slight contraction. The curve shows two break points at vacuum. It forms a crystalline, snow-white powder, readily soluble in water.

E. H. R. (*Jour. Chem. Ind.*)

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60. Calcining alunite. H. F. Chappell. U. S. 1,401,136, Dec. 27. Alunite is calcined at a temp. sufficiently high to volatilize K_2SO_4 and convert all the Al compds. present into Al_2O_3. The mass is agglutinated at its surface by the partial fusion and softening of the K_2SO_4 and the agglutinated superficial layer is removed as it forms from the zone of high temp. in order to avoid volatilization of the K_2SO_4 which would otherwise occur. According to U. S. 1,401,137, Dec. 27, alunite is heated, after the greater

portion of the fumes of Sioxides have been given off, in the combustion zone of a rotary kiln in order to complete calcination. (*C. A.*)

61. **Treating alunite.** M. Shoeld. U. S. 1,401,741, Dec. 27. Alunite is heated to about 500–600° with 3–5% of C in a reducing atm. partially to decompose the Al sulfate without decompn. or volatilization of the K_2SO_4. The products are dissolved and crystd. (*C. A.*)

62. **Brick furnaces or kilns.** J. Boyer. E. P. 172,062, July 28, 1920. A single kiln, or each of a series of kilns, is provided with a partition, open at the top, whereby gases burnt on one side of the partition pass over it, through the material (bricks) to be fired on the opposite side of the partition and then pass out through flues in the floor of the kiln, the gases being supplied by a gas plant and drawn, with the air required for combustion, through the kilns by a suction fan. The chambers and flues may, if desired, be built of the materials to be heated or dried. When the kilns are arranged in series the hot gases may pass consecutively from one to another so as to heat each chamber in turn, suitable shutters being provided to control the flow of the gases, or the kilns may be arranged to form a tunnel, each chamber being then composed of two fixed side walls, with two movable walls built on the platform of a wagon which travels on a track through the kilns. The walls of the chambers may be made with parts of U-shape, the limbs of which engage with one another, so that one set of walls may be moved with respect to the other set and the size and shape of the chamber altered accordingly. Each kiln may also be provided with a heat-recuperating chamber, either movable or fixed, for heating the air required for the combustion of the gases. Such air may, if desired, be blown into the kiln under pressure. A. B. S. (*Jour. Chem. Ind.*)

63. **Gas-fired continuous kilns.** J. and H. Morton. E. P. 172,099, Aug. 28, 1920. In a gas-fired kiln having a number of chambers arranged in series, each chamber is in direct communication with the adjacent chamber through a number of apertures provided with dampers which are clamped between an angle-iron rail and a flat rail. These rails are supported on rollers in a transverse trough below the floor-level, the top of the trough being closed by bricks. The outer end of the rail projects into a recess in the outer wall of the kiln and is provided with a lever and screw mechanism by means of which the slabs can be caused to cover or uncover the openings to any desired extent. A. B. S. (*Jour. Chem. Ind.*)

Abrasive

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64. **Abrasive.** C. J. Brockbank. U. S. 1,402,714, Jan. 3. Bauxite is roasted with Na_2CO_3 or K_2CO_3 to combine with oxides present as impurities and the oxides are subsequently removed by fusion with C and treatment with H_2SO_4. (*C. A.*)

Stoneware, Whiteware and Porcelain

65. **Porcelains for electric insulators.** O. Boudouard. *Chimie et industrie*, **6**, 583–91(1921).—See *Jour. Am. Ceram. Soc.*, **4**, 246(1921). A. P.-C. (*C. A.*)

66. **Present demands on porcelain insulators.** W. Weiker. *Elektrotechn. Z.*, **41**, 1475(1921); **42**, 1508(1922).—A very comprehensive review. C. G. F. (*C. A.*)

Art and Design

See Abs. 7.

67. **Relation between silica, alumina and basic oxides in porcelain glazes fired at high temperatures.** Yaichiro Kitamura. *J. Chem. Ind.* (Japan), **24**, 89–105(1921).—227 different combinations were prepd. within limits of 1.0 RO, 0.2–2.2 Al_2O_3, 4.0–

26.0 SiO_2, using for RO, 0.5 KNaO + 0.5 CaO in one set, and 0.1 KNaO + 0.9 CaO for the balance. The Al_2O_3 was varied in 0.2 equiv. steps and the SiO_2 in 2.0 equiv. Burns were at cones 11, 14, and 17. The results are given in 6 charts. The limits for good glazes are much greater at the higher temp. Good glazes are (1) for 1.0 RO (0.5 KNaO, 0.5 CaO) at cone 11, 0.9 Al_2O_3, and 8.0 SiO_2; at cone 14, 1.05 Al_2O_3, 10.0 SiO_2; and at cone 17, 1.1 Al_2O_3, and 15.0 SiO_2. (2) For 1.0 RO (0.1 KNaO, 0.9 CaO), at cone 11, 0.7 Al_2O_3, 5.0 SiO_2; at cone 14, 0.95 Al_2O_3, 9.5 SiO_2; and at cone 17, 1.1 Al_2O_3 and 14.5 SiO_2. Suitable compn. of semi-mat and mat glazes are also discussed in detail. S. T. (*C. A.*)

Heavy Clay Products

68. The utilization of crude lignite for brick burning. Weizz and Becker. *Braunkohle*, **20**, 310–12(1921).—Whereas 180 kg. of hard coal are required to burn 1000 bricks, 500 kg. of dried lignite, such as Rhenish, are necessary. The utility and economy of lignite depend chiefly upon proximity to the source of supply. C. C. Davis (*C. A.*)

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69. Pottery; artificial stone. R. Tralls. Brit. 172,295, Nov. 25, 1921. Minerals contg. clay, lime, or iron and bituminous materials are smelted by means of their own combustible constituents in the production of castings. The minerals mentioned are various clays, lime formations, and iron oxides which are found in lignite and black coal swamps, turf or moor deposits, or independent deposits such as aluminite, oil schist and certain marls having bituminous constituents. The air dried materials are heated in a smelting furnace by the waste combustible gases until incandescent, when the combustible constituents complete the smelting. If necessary, a small proportion of coal, etc., may be added and a flux such as lime, gypsum, fluorspar, etc., introduced. For coloring and varying the quality of the casting, metals or metallic compds. are employed. (*C. A.*)

Glass

70. The effect of temperature upon the ultraviolet absorption of glasses. Walter Rieder. *Jahrb. Phil. Fak. II, Univ. Bern.*, **1**, 148–54(1921).—Twelve var. of glass were studied at temps. up to 450° and in one case down to the temp. of liquid air and with wave lengths down to 2250°. All var. exhibited a transmission limit below which the transmission for all shorter wave lengths was zero. Increase of temp. in all cases raised this transmission limit toward the region of longer wave lengths. The var. data are recorded in the author's thesis Ms. in 48 tables. The present paper is only an abs. E. W. W.

71. The interaction of silica, sodium oxide and barium oxide. Part XII of "The Development of Various Types of Glass." C. J. Peddle. *J. Soc. Glass Tech.*, **19**, 201–11(1921).—Two series of glasses were prepd. and studied. One series was based on mol. type 100 SiO_2, 40 Na_2O, x BaO, where x varied from 5 to 40 at intervals of 5, the other based on mol. type 100 SiO_2, 20 Na_2O, x BaO, where x varied from 5 to 40 at intervals of 5. The *density* and *refractive index* increase with an increase in barium oxide and also with an increase of sodium oxide, the increase for sodium oxide holding for d. when the mol. barium oxide content is less than 16 mols. and for refractive index when the content is less than 25 mols. Total *dispersion* increases with the addition of either barium or sodium oxide, the rate of increase being greatest in barium series containing the least sodium oxide. Most of the glasses tested did not have good weathering properties and were easily devitrified. W. C. Taylor

72. The interaction of silica, potassium oxide, and barium oxide. Part XIII of "The Development of Various Types of Glass." C. J. Peddle. *J. Soc. Glass Tech.*, **19**,

212–220(1921).—Two series of glasses similar to those in Part XII of this series except with K_2O instead of Na_2O, were prepd. and studied. It was found in these series that the *density*, *refractive index*, and total *dispersion* increase with increasing barium content and that the *solubility* decreases as the barium oxide content increases. All the glasses showed a tendency to *devitrification*. W. C. TAYLOR

73. The interaction of silica, barium oxide, and the oxides of sodium and potassium. Part XIV of "The Development of Various Types of Glass." C. J. PEDDLE. *J. Soc. Glass Tech.*, **19**, 220–28(1921).—Glasses of the mol. types 100 SiO_2, Na_2O, 20 K_2O and 100 SiO_2, 10 K_2O, 10 Na_2O, x BaO were investigated, x varying from 5 to 40 mols. As in the other series the *density*, *refractive index* and *total dispersion* increases as the proportion of barium oxide increases, the *solubility* increasing as the barium oxide content decreases. None of the glasses were of first class durability. W. C. TAYLOR

74. A comparison of the alkali-barium oxide-silica glasses. Part XV of "The Development of Various Types of Glass." C. J. PEDDLE. *J. Soc. Glass. Tech.*, **19**, 228–256(1921).—A long series of soda barium, potash barium and soda-potash barium silicates were studied. Statistics are given in regard to effect of compn. on *color, density, refractive index, dispersion, devitrification, form of crystals, solubility, durability,* and *pot attack*, and some general conclusions drawn. W. C. TAYLOR

75. A comparison of the alkali-barium silicate and alkali-lead silicate glasses. Part XVI of "The Development of Various Types of Glass." C. J. PEDDLE. *J. Soc. Glass Tech.*, **19**, 256–68(1921).—A comparison of the results obtained in the preceding papers on lead and barium glasses discussing the relative effects in regard to *density, refractive index, total dispersion, value, devitrification, solubility and durability.* W. C. TAYLOR

76. The shrinkage porosity and other properties of British fire-clay after being fired at high temperatures. EDITH M. FIRTH AND W. E. S. TURNER. *J. Soc. Glass Tech.*, **19**, 268–76(1921).—Detns. of the shrinkage, porosity, and apparent and real *specific gravities* of 26 British and 1 German clay were made at 1500°C. Ten of the clays including the German, undergo permanent linear expansion between 1400° and 1500°; seven including the German, undergo decrease of apparent sp. gr. and only two show appreciable increase of porosity; two of the clays underwent over-firing before 1500° and two developed blistering to a slight extent. (*Jour. Amer. Ceram. Soc.*, **4**, 68(1921)). W. C. TAYLOR

77. The density of glasses containing aluminum. S. ENGLISH AND W. E. S. TURNER. *J. Soc. Glass Tech.*, **19**, 277–80(1921).—Curves are given to show d. of *sodium-calcium, sodium-magnesium* and *sodium-aluminium silicates.* Although wt. for wt. 1% of magnesia, the substitution of alumina for lime or soda reduces the d. very considerably. Density factors are also discussed. W. C. TAYLOR

78. Measurement of the double refraction in tempered glass. TAFFIN. *Compt. rend.*, **173**, 1347–50(1921).—The double refraction in the strained glass is balanced by that caused in an annealed plate of glass under a variable load in a testing machine. E. D. WILLIAMSON (*C. A.*)

79. Polishing glass by means of acids. O. PARKERT. *Zentr. Baukeram.*, **35**, 1–2 (1920); *Chimie et industrie*, **6**, 631(1921).—The material to be polished is thoroughly cleansed by means of a 12% H_2SO_4 and 1% HCl bath. It is then immersed for 45 sec. in a bath consisting of 1 part water, 2 parts H_2SO_4, and 1 part HF, which is kept at 35°, and is then washed with water. If necessary the treatment is repeated. Fine glassware is sometimes rubbed with putty powder. A. P.-C. (*C. A.*)

80. Annealing of glass. E. D. WILLIAMSON. *J. Wash. Acad. Sci.*, **12**, 1–6(1921).—A mathematical discussion of the most rapid methods of annealing glass. Schedules are given for carrying out the process in a shorter time than has previously been used. E. D. WILLIAMSON (*C. A.*)

81. A novel leer installation. ANON. *Nat. Glass Budget*, **37**, No. 34, 14(1921).—The Columbia Glass Co. of Fairmont, W. Va., is trying out a small leer of steel and asbestos which requires no external heat for its operation. The newly made ware is introduced into it quickly and the excellent insulation of the leer conserves the original heat of the glass sufficiently to anneal it in $^3/_4$ of an hour. The chief difficulty, it is claimed, is the regulation of the heat to avoid melting the ware.

J. B. PATCH (*C. A.*)

82. Recommended specifications for limestone, quicklime, and hydrated lime for use in the manufacture of glass. ANON. The Bur. Standards, *Circ.*, No. **118**, 7 pp. (1921).—This is based on a draft originally prepared by A. E. Williams, of the Glass Section of the Bureau, and has been unanimously approved by a "conference" composed of representatives of the Geol. Survey, Bur. Mines, Bur. Soils, Bur. Chemistry, Forest Service, Fixed Nitrogen Research Lab., and The Chemical Warfare Service. It has also been "adopted as tentative by a majority vote of the Standardization Committee of the Glass Division of the Am. Ceramic Society." G. E. BARTON (*C. A.*)

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83. Glass manufacture. T. B. KETSON. Brit. Pats. 170,882, 170,883, May 7, 1921. *Ill. Off. Jour. Pats.*, Dec. 21, 1921, p. 5707. Relates to bottle blowing machines, and ratchet gearing for same. With illus. WM. M. CLARK

84. Glass manufacture. PHILLIPS LAMP WORKS. Brit. Pat. Appl. 172,289. *Ill. Off. Jour.*, Jan. 25, 1922, p. 6223. Describes a process for drawing glass tubing or cane continuously from a supply of molten glass. The metal flows from a tank inside an inclined rotating cylindrical chamber, which is heated. Diagrams included.

WM. M. CLARK

85. Glass working. BRIT. THOMSON-HOUSTON CO. AND G. E. CO., Brit. Pat. 171,232, Sept. 3, 1920. *Ill. Off. Jour. Pats.*, Dec. 30, 1921, p. 5837. Describes a machine for flaring the ends of glass tubes, especially those used as parts in the manuf. of incandescent lamps. Sketched. WM. M. CLARK

86. Glass. E. W. ENEQUIST. U. S. 1,403,752, Jan. 17. Basic soda slag contg. ferrous Fe is used in glass together with sand and other glass-making materials to form a black glass adapted for use alone or as a glaze. (*C. A.*)

87. Glass manufacture. WESTINGHOUSE LAMP CO. Brit. 170,563, Sept. 15, 1921. Glass which will resist the action of the vapors of alkali metals in vapor elec. lamps is composed of a mixt. of oxides such as Na_2O 13, Al_2O_3 15, CaO 12, B_2O_3 60%. Such glass withstands temps. of 400-600° in Na vapor lamps. (*C. A.*)

88. Glass manufacture; electric insulation. P. SCHUDI-FREULER. Brit. 171,692, Nov. 15, 1921. Black glass, which is of use as an elec. insulating material, and which has a small thermal expansion, is made by melting a natural rock such as schist, consisting chiefly of quartz, lime, and Al_2O_3 and adding a further quantity of one or more of these substances until the melted product contains approx. 1 part of Al_2O_3, 1.65 parts CaO, and more than 3.56 parts of SiO_2, the amt. beyond 3.56 parts being calculated so that all other oxides present may be converted into silicates. The main ingredient of the finished product has the chemical formula $(SiO_2)_6.Al_2O_3.(CaO)_3$ and melts at about 1250°. (*C. A.*)

89. Electric glass-annealing furnace. O. A. COLBY. U. S. 1,401,674, Dec. 27. (*C. A.*)

Enamels

90. Enamels for tinware. ANON. *Taschenbuch für Keramiker, Keram. Rundschau*, 37–40(1922).—

TABLE I

GROUND COATS

	I Fritt	II Fritt	III Fritt	IV Fritt	V Fritt
Boric acid	0.0	0.0	0.0	0.0	240.0
Borax	371.0	32.0	44.0	374.0	115.0
Feldspar	333.0	28.0	31.0	335.0	96.0
Quartz	192.0	20.0	17.0	196.0	231.0
Calcined soda	45.0	6.0	3.0	56.0	0.0
Fluorspar	37.0	3.0	4.0	39.0	38.0
Whiting	0.0	9.0	0.0	0.0	0.0
Potassium nitrate	22.0	2.0	1.0	0.0	0.58
Manganese silicate	0.6	0.5	0.0	0.50	212.0
Cobalt oxide	0.3	0.2	0.1	0.25	0.0
Nickel oxide	0.0	0.0	0.1	0.0	0.0
Magnesia	0.0	0.0	0.0	0.0	10.0
	Mill mixt.	Mill mixt.		Mill mixt.	Mill mixt.
Fritt	94	92		94	90
Clay	6	8		6	10

TABLE II

WHITE ENAMEL

	I Fritt	II Fritt	III Fritt	IV Fritt	V Fritt	VI Fritt
Feldspar	386.0	0.0	220.0	235.0	353.0	32.0
Quartz	190.0	297.0	175.0	314.0	205.0	8.0
Borax	154.0	229.0	300.0	162.0	168.0	26.0
Calcined soda	0.0	117.0	135.0	93.0	0.0	9.0
Cryolite	117.0	0.0	0.0	157.0	120.0	5.0
Potassium nitrate	65.0	80.0	20.0	31.0	64.0	3.0
Whiting	65.0	0.0	0.0	0.0	70.0	0.0
Fluorspar	13.0	0.0	0.0	0.0	20.0	6.0
Magnesite	10.0	0.0	0.0	0.0	0.0	0.0
Magnesia	0.0	37.0	0.0	8.0	0.0	0.0
Tin Oxide	0.0	240.0	150.0	0.0	0.0	11.0
	Mill mixt.	Mill mixt.		Mill mixt.	Mill mixt.	Mill mixt.
Fritt	84.0	94.0		90	85	86
Tin Oxide	10.0	2.0		6	10	8
Quartz	0.0	4.0		0	0	0
Clay	6.0	0.0		4	5	6

Colored enamels are obtained by the addition of the foll. ingredients. *Violet:* Manganese silicate; *Green:* Copper oxide with or without iron oxide or chromium oxide. With the last oxides one obtains only a translucent green, since tin oxide produces a pink tinge. Cryolite also spoils the green color. *Brown:* Iron oxide or manganese silicate; *Gray:* Nickel oxide or iron scale; *Black:* Cobalt oxide and manganese silicate; *Red:* For a cheap red, iron sulphate is calcined with alumina until the body takes a good red color. This color is then added to the enamel in a predetermined amount. Cadmium selenide and copper oxide and gold produce good red colors; *Rose:* Manganese oxide; *Orange:* Red ochre. H. G. SCHURECHT

91. **Operating costs of electric furnace for baking vitreous enamel.** ANON. *Elec.*

World, **79**, 286(1922); 1 illus.—Production was increased and costs were reduced by substituting elec. for oil-fired enameling furnaces. Detailed figures are given. C. G. F. (*C. A.*)

92. Electric enameling oven. E. KRAMER. *J. Elec. Western Ind.*, **48**, 114(1922); 1 illus.—Details of construction and operation of an automatic oven enameling 40 lbs. of metal per kw. hr. C. G. F. (*C. A.*)

Cement, Lime and Plaster

93. Contribution to the knowledge of the processes which occur during the formation of mortars. AUGUST ZELLWEGER. *Lab. Anorg. Chem. Bern. Jahrb. Phil. Fak., II, Univ. Bern.*, **1**, 102–106(1921).—*Sedimentation experiments.* The oxides CaO, MgO, and CaO were separately treated with an excess of water or of solutions of electrolytes and the velocity of slime deposition measured. The influence of the various ions was in general the same for the different oxides and seemed to be determined largely by the colloidal condition of the oxide. The phenomena of adsorption and swelling apparently were involved in the behavior shown.

MgO volume changes. The volume changes which accompany the slaking of MgO were studied dilatometrically. An initial expansion followed by a subsequent contraction was observed. The relative influences of various salts upon the expansion were the same as in the sedimentation expts. The final contraction was not affected by electrolytes.

The hardening of MgO slime. The influences of various electrolytes were in the same order as in the preceding experiments.

Conclusions. Colloidal swelling is the first step in the slaking process and colloidal processes are responsible for the various phenomena which accompany slaking. E. W. W.

94. Accelerated test of portland cement. S. KANOH. *J. Chem. Ind.* (Japan), **24**, 675–99(1921).—Different methods now in use for accelerated tests are classified. The test for strength is as important as the test for constancy of vol. when the test is to ascertain the quality of the cement in a short period. Comparison of strength, expansion, and degree of hydration of 2 cements at 97–8°, and also at room temp. (8–13° and 11–18°) showed that hydration and hardening are remarkably accelerated by rise of temp. The results obtained by other investigators from strength test may be due to the irregularities to their tensile tests, in which the strength retrogression in course of hardening in longer period may not be the indicator of the true characteristic of the cement, but may be the result of eccentric loading, to which the tensile briquets are subjected. The accelerated tests for strength should be made not for tensile, but for compressive strength of mortar of cement and sand. Twelve charts and 7 tables are given to show the detailed results. S. T. (*C. A.*)

95. A new hydraulic magnesium cement. A. CH. VOURNAZOS. *Compt. rend.*, **172**, 1578–80(1921).—Hydraulic cement can be made from Greek magnesite if it is burned at a temp. only just high enough to expel the CO_2 and then mixed with amorphous silica or some substance contg. it, *e. g.*, pumice, pozzuolana or volcanic ash. The ratio should be 2 MgO : SiO_2 (amorphous). Pumice from Santorin contains 65% of SiO_2, of which 18/65 is amorphous (sol. in dil. KOH). The pumice has also 15% Al_2O_3 and 3% CaO. The rest is Fe_2O_3, TiO_2, MnO_2, MgO and alkalies. Greek (Euboean) magnesite is calcined without vitrifying. The rise of temp. is checked at the CO_2 expulsion point and the heating continued at that level. The product is ground to 80-mesh and stored. When mixed with fine pumice or pozzuolana and water, setting takes place in 48 hrs. in air or 90 in water: hardening continues for more than a year. 100 parts of pumice, contg. 18% amorphous SiO_2, require 24 parts of pure MgO or 30 parts of calcined Greek magnesite. The pumice is ground to pass 60-mesh. 35 parts of sand

are added if contraction strains are to be avoided. This mixt., after gaging with water and hammering into molds, shows strength as follows in kg. per sq. cm. (× 14.48 = lbs. per sq. in.).

	Air		Water	
	Tensile	Crushing	Tensile	Crushing
7 days	6.50	81	5.40	65
28 days	9.25	105	7.00	72
3 months	14.50	144	10.75	98
6 months	18.50	181	14.20	118
12 months	21.20	201	17.75	141

Max. strength is not then reached. Mortars are unchanged in appearance. Color is gray and grain is fine. They take paint well and may be used for interior or for exterior walls. They attack iron less than portland cement mortar does and their coeff. of expansion is almost that of iron. This magnesian cement is well suited for use in reinforced concrete. A pure white imitation marble, etc., may be made from 100 parts calcined magnesite, 60 parts amorphous SiO_2 and 70 parts of 30-mesh quartz sand. It sets in 40 hrs. It is unalterable like the pumice cement but no stronger. It is called "Leucociment." J. O. Handy (*C. A.*)

96. Acid-proof cements and stone. Theo. Utzel. *Chem.-Ztg.*, **45**, 1069–70(1921).—Cements based on water-glass are used extensively in the chem. industry. In H_2SO_4 plants they are used for luting the joints of monte-jus and for setting tiles in the denitrating towers. Because such cements harden quickly at the surface but only very slowly inside, they are often forced out by pressure before complete setting. Setting can be hastened by application of dil. HCl or H_2SO_4 to the cement in the joint. Even then, the inner part of the cement may not be affected. If more porous tiles are used the cement hardens better. German patent 784,111 relates to a process for making acid-proof stone. Jas. O. Handy (*C. A.*)

97. The protection of concrete and cement against the action of sulfates by means of barium carbonate. H. Nitzche. *Cement*, **10**, 1–2, 13–5(1921); *Chimie et industrie* **6**, 799(1921).—N. considers that after all the $BaCO_3$ has reacted with the sulfates, the action of further quantities of sulfates takes place quite readily. The reaction $BaCO_3 + CaSO_4 = BaSO_4 + CaCO_3$ is probably not the only one, and other reactions and accessory phys. phenomena probably come into play. Mortars to which no $BaCO_3$ had been added behaved very well, both when immersed in sulfate-bearing waters and when exposed to the atm. for 4 weeks, while all the samples treated with $BaCO_3$ behaved abnormally to varying degrees. A. P.-C. (*C. A.*)

98. The chemical composition of cement. D. I. Bujor. *Contrib. Stub. Compoz. Chim. Ciment*, **1920**, 5–18; *Chimie et industrie*, **6**, 799(1921).—During the calcination of a mixt. of clay and limestone at 1200–1700° the partial fusion of SiO_2, Al_2O_3, Fe_2O_3, CaO and MgO gives rise to a semi-fluid soln. which reaches a state of mol. equil. SiO_2, Al_2O_3 and Fe_2O_3 are equiv. and constitute the acid portion, while CaO and MgO are equiv. and constitute the basic portion. Within the limits of the chem. equil. the proportions of acid constituents can vary rather widely, while the basic constituents vary within very narrow limits. The equil. in the semi-fluid soln. is represented by $(SiO_2 + Al_2O_3 + Fe_2O_3) : 2.34\ (CaO + MgO)$. On cooling it solidifies completely forming pure cement. Below 1200° the proportion of pure cement is lower, part of the $CaCO_3$ being undecomposed or remaining as free CaO and part of the clay being mixed with the cement as insol. silicates. Above 1700° CaO and the excess of SiO_2 form silicates low in CaO which do not set with water. A. P.-C. (*C. A.*)

99. Researches with blast-furnace slags. H. Burchartz. *Mitt. Materialprüfungsamt*, **38**, 149–63(1921); cf. *Ceram. Abs.*, **5**, 50(1922).—This is the 3d and final report to the Commission for the Investigation of the Suitability of Blast-furnace Slag for Con-

crete. Previous tests at Heligoland had not shown durability in sea water but the mixt. had been lean. The new tests lasted 3 years and were carried on with concrete made in one case with portland cement and in the other with iron portland. The slag sand and coarser sizes were carefully graded to obtain max. d. Check samples were made up with no slag but with Rhine sand and gravel. Slags from several sources were tried. Steel reënforcement, clean, rusty or scale covered were embedded. All of these metal samples were free from rust in a short time and none became rusty later, the samples having been perfectly protected from both air and sea water for 3 years. This was true also of the sand and gravel concrete. The d. of concrete controls its durability in sea water. The mixts. were 1 part cement, 2 parts slag-sand and 3 parts coarser slag. The slag-sand varied from 1 to 7 mm., the coarser slag from 7 to 25 mm. and from 25–40 mm., the latter forming $^2/_3$ of the coarser slag. After 3 yrs. the concrete made with iron portland cement was 9% stronger than the portland in the case of the slag mixt. and 6% in the sand and gravel one. Slag concrete from portland cement was 5% and from iron portland it was 8% stronger than sand and gravel concrete. JAS. O. HANDY (*C. A.*)

100. Relation between the clay content and certain physical properties of soil. B. A. KEEN AND H. RACZKOWSKI. *J. Agric. Sci.*, **11**, 441–49(1921).—A simple process for determining the following physical properties of soils is described: Apparent specific gravity, water taken up by unit volume of soil, pore space, specific gravity, volume expansion of soil when saturated with water. The specific gravity and apparent specific gravity vary inversely, and the absorptive power for water, the pore space, and the volume expansion of the saturated soil vary directly with the percentage of clay in the soil. The effect of organic matter on the constants mentioned is approximately the same, weight for weight, as that of clay. A. G. P. (*Jour. Chem. Ind.*)

101. Flocculation of soils. II. N. M. COMBER. *J. Agric. Sci.*, **11**, 450–471(1921). (Cf. J., 1920, 793 A).—The clay particle is assumed to consist of a central core surrounded by an emulsoid protective layer, and coagulation may result in three ways. "Normal" flocculation, as by salts of iron and aluminium, is precisely similar to the coagulation of electro-negative suspensoids by electrolytes. "Indirect" flocculation results from interaction between the flocculant and the constituents of the clay particle, whereby normal flocculants are produced. The action of some neutral salts and acids is of this type. "Abnormal" flocculation, as in the case of lime, is due to a reaction between the flocculant and the emulsoid surface layer of the particle. Although the flocculating effects of calcium hydroxide are reversible to carbon dioxide, the formation of calcium carbonate is not an essential part of the process. The hydroxyl ion may function in two ways in conjunction with the calcium ion. If added with or after the calcium ion, it produces the necessary alkalinity for the reaction between calcium salts and silica, etc. but if added before the calcium, the emulsoid surface of the clay is peptised and flocculation becomes more rapid and the volume of the coagulum greater. The difference in the action of lime on clay and on silt particles depends only on the relative proportions of emulsoid surface and core of the particle. A. G. P. (*Jour. Chem. Ind.*)

PATENTS

102. Cement composition. H. RICH. U. S. 1,404,060, Jan. 17. A mixt. adapted for road surfacing or brick making is formed of finely ground portland cement and clay together about 32, earthy material about 64 and finely powdered glass, SiO_2 or other similar hard material about 1–5 parts. KNO_3, S and creosote may be added. (*C. A.*)

103. Potash and white cement. A. C. AUGEN. Can. 213,611, Oct. 4, 1921. Mineral-contg. silicates of Fe and K are roasted with lime and salt, the coarser parts are sieved out and reground and the whole is treated under pressure in a closed vessel with steam and hot water to wash out the K. The water is sepd. from the solid matter, which is mixed with lime and roasted to produce white cement. (*C. A.*)

104. **Kiln for burning lime or cement.** J. H. Lemmon. U. S. 1,401,481, Dec. 27. The kiln has a central bridge wall spaced to allow for expansion and provided with gas supply flues. (*C. A.*)

105. **Cold glaze for cement.** K. Friedrich. U. S. 1,402,412, Jan. 3. A cold glaze for cement or other building materials is prepd. by mixing a finely sifted sand-free colored cement with an aq. emulsion of derivs. obtained by oxidizing bituminous material in the presence of alkalies and free from volatile oils. (*C. A.*)

106. **Cements.** Bombrini Parodi-Delfino. Brit. 170,063, July 5, 1920. A slow-setting cement free from Ca aluminates and ferrites is prepd. by adding Fe_2O_3 to the usual ingredients of portland cement, so that the ratio of Fe_2O_3 to Al_2O_3 is between 1 and 1.563 to 1. Siliceous sand is also added to restore the ratio of SiO_2 to sesquioxides to the normal value. The materials are treated in the usual manner. (*C. A.*)

107. **Manufacture of earthenware.** C. E. Fulton. U. S. 1,398,014, 22.11.21. Appl., June 7, 1919. Material for the manufacture of clay goods is treated with a mixture of an alkali hydroxide, a soluble alkali silicate, and a deflocculating agent of the nature of gallic acid. C. A. K. (*Jour. Chem. Ind.*)

BOOK REVIEWS

Fluidity and Plasticity. Eugene C. Bingham, Ph.D. International Chemical Series. pp. x + 440 + 96 figures. McGraw-Hill Book Company, New York, 1922.

Bingham after many years of careful and painstaking experimentation in the field of plastics has finally brought out a work that will prove to be a standard of reference in a nearly virgin field.

The author develops and clarifies the laws of flow in a way to suit the mathematically as well as the experimentally inclined. He neither sidesteps mathematical derivation of formulae where necessary, nor does he fail to give consideration to the more technical aspects of flow.

The laws of flow as related to gases, liquids, solutions, suspensions and solids are up in order in the first few chapters and applications of the same to technical processes are made in the latter half of the book.

The arrangement of the text is excellent. A summary of the fundamental considerations in a few of the chapters is given. It is so thorough that one feels that this could have well been continued throughout the text.

Not of least value are the appendix and index, which latter takes the form of a very complete bibliography. The appendix contains sections of practical viscometry and plastometry, technical viscometers and some valuable tables.

The book is vital to ceramic research and technology. It is hardly fair to commend one chapter above another but those of more vital interest to the ceramic man are "Viscosity and Fluidity," "Colloidal Solutions," "Plasticity of Solids," "Lubrication" together with the appendix above mentioned.

After a careful examination of the book one can not but feel that a wide gap in our literature has been adequately filled. G. A. Bole

Zirconium and Its Compounds. Francis P. Venable. American Chemical Monograph Series. Pp. 169. The Chemical Catalog Company, Inc., New York, 1922.

A thorough compendium of this subject. The book takes up the history, the reduction and properties of the metal, and the compounds of the various classes in an orderly way. It closes with analytical methods and technical applications. Then follows a complete list of patents with abstracts of each and a complete bibliography. In this the author's twenty original contributions deservedly shine. The text is replete with references. The presswork and binding are excellent. F. G. Jackson

CERAMIC ABSTRACTS

Compiled by the

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General and Miscellaneous

1. Experiments with heat interchangers. F. R. Bichowsky. *J. Ind. Eng. Chem.*, **14**, 62–64(1922).—In liquid air machines and other refrigerators the loss of efficiency due to poor thermal insulation ordinarily is small compared with that due to poor interchange. The efficiency of heat interchange was studied by means of an apparatus consisting of a gas-conducting tube, 0.124 in. in internal diam., through which was stretched centrally a wire of No. 40 constantan. Leads of No. 40 copper wire were connected with the ends and the middle of the constantan wire, the whole forming a differential thermoelement giving the temperature of the gas at these points. The tube was immersed in a bath of liquid air. The temperature drop per unit length of tube was independent of the pressure, inversely proportional to the rate of flow of gas through the tube, and proportional to the temperature head from bath to incoming gas. A formula is given by which it is possible to calculate the length of tubing necessary for an ideal interchanger of given thermal efficiency. The results accord with practice in interchangers of the best design. Liquefiers of copper tube, flattened, and twisted to enable it to stand high pressure without bulging, may give an efficiency of 70% of theory.

H. M. (*Jour. Chem. Ind.*)

2. Burning of pulverized fuel in paper mill power plants. Loren L. Hebberd. *Tech. Assoc. Papers*, **4**, No. 1, 13–21(1921).—A general exposition of the advantages of using pulverized fuel in paper mill power plants, both in new mills and in old mills at present operating with stokers, with estimates of costs and savings. Discussion.

A. P.-C. (*C. A.*)

3. Volumetric and gravimetric methods for the determination of zinc in practice. Stefan Urbasch. *Chem.-Ztg.*, **46**, 6–7, 29–30, 53–5(1922).—In these 3 installments, the treatment of Zn ores, the effect of impurities, and details concerning titration with $K_4Fe(CN)_6$ are discussed and the results of certain test analyses are given. To dissolve the ore, treatment with about 20 cc. of 12 *N* HCl, 1 cc. of concd. HNO_3 and enough HF to react with SiO_2 is recommended, after which the soln. is evapd. to fumes with 7 cc. H_2SO_4. To remove metals of the Cu group, treatment with H_2S appears to be indispensable. Fe, Mn and Al are best removed by treatment with Br and the presence of a suitable concn. of NH_4OH and NH_4Cl. The removal of Al is shown to be necessary and the effect of NH_4 salt is noticeable, but best compensated by standardizing with the same concn. as in the analysis. Instead of using an outside indicator, it is better to add about 0.2 mg. of Fe to the soln. in the form of $FeCl_3$ and then, in the hot soln., the endpoint is reached when the color changes from pale blue to white or pale yellow. It is well to add a slight excess of ferrocyanide and titrate back with standard Zn soln. The ferrocyanide soln. will keep indefinitely if kept in contact with H_2. W. T. H. (*C. A.*)

4. A new method for the detection and estimation of cobalt. S. A. Braley and F. B. Hobart. *J. Am. Chem. Soc.*, **43**, 482–4(1921).—A brown color is always obtained when a soln. contg. Co is treated with dimethyl glyoxime and the color does not disappear, as does that of most oximes, upon the addn. of mineral acids. This color reaction may be used as a test for Co in the absence of interfering substances such as Cu and Fe and as a basis for the colorimetric detn. of Co. W. T. H. (*C. A.*)

5. Activity coefficients and colligative properties of electrolytes. H. S. Harned. *J. Am. Chem. Soc.*, **44**, 252–67(1922).—On the basis of an empirical equation $\log F_a = \alpha c - \beta c^m$ which relates the activity coeff. (F_a) of an electrolyte with the mol. concn. (c) at a given temp. (α, β and m being consts.) and Duhem's equation, $N_1 d\alpha F_1 = - N_2 d\alpha F_2$, where N_1, N_2, F_1 and F_2 are mol. fractions and free energies of the electrolyte and water, equations are derived for calcg. vapor pressures of solns. In all the 13 electrolytes studied the empirical equation holds up to $3M$, above which the equation fails for H_2SO_4 and HCl. A special study of the activity coeffs. of KCl, NaCl and HCl was made and the parameters (α, β and m) for the 13 electrolytes were tabulated, from which the vapor pressures and osmotic pressures can be calcd. The equation, admittedly empirical, should prove useful in testing existing data and in organizing colligative data of concd. solns. James M. Bell (*C. A.*)

6. Patent legislation and the chemical industry. André Taillefer. *Chimie & industrie*, **6**, 845–7(1921).—Discussion of process patents and product patents. A. P.-C. (*C. A.*)

7. The phenomena of layer formation in clay suspensions and their application to soil analysis. E. Ungerer. *Kolloidchem. Beihefte*, **14**, 63–96(1921).—The literature is reviewed. Expts. were conducted with centrifuged suspensions of ultramarine blue and ultramarine red, as well as by settling under the influence of gravity. Samples were removed from each distinct layer of the suspension, and the no. of particles counted. The size of the particles was also calcd. from the Stokes equation (size of particles expressed as function of velocity of settling, viscosity of the medium, d. of particles, d. of medium). Observed and calcd. values agree well. Emulsions (gum arabic, oil and H_2O) exhibit the same phenomena. To det. the conditions for the formation of layers, the size and d. of the individual particles must be considered; each sep. layer indicates particles of definite size. Different strata indicate definite differences in wt. and size of the particles. Each layer reaches to the bottom of the contg. vessel. Const. temp. conditions influence largely the formation of definite strata of turbidity. The layers are formed equally well in suspensions contg. electrolytes and in those which are electrolyte-free, excepting electrolytes with marked coagulating power. The particles of each stratum sink (or rise) with equal velocity. From the velocity of falling (or rising) with the help of the *Stokes equation* one can establish the characteristic size of each group in contact with solid surfaces, and are not due to higher free energy content of atoms in nascent state because when mols. are dissociated by heat the resulting atoms show no properties, save those arising from increase in number, not already shown by the undissociated mols. By causing H to bubble in a soln. through a filter paper extn. thimble, Z. found a soln. of $HgCl_2$ was appreciably reduced. Similarly O oxidized NH_3 to HNO_2 and N and H united sufficiently to give a reaction with Nessler's reagent. J. C. (*C. A.*)

8. Molecular structure of amorphous solids. C. V. Raman. *Nature*, **109**, 138–9 (1922).—The magnitude of the scattering of a beam of light by glass lends support to the view that the arrangement of the mols. is irregular rather than that they are packed together at more or less uniform distances apart as in crystals. W. H. R. (*C. A.*)

9. Research laboratories in industrial establishments of the United States, including consulting research laboratories. A. D. Flinn and Ruth Cobb. *Bull. Natl. Research Council*, **3**, Pt. 1, 1–135(1921). E. J. C. (*C. A.*)

10. **Fuller's earth deposit at Olmstead, Ill.** C. W. Parmelee. *Chem. Met. Eng.*, **26**, 177(1922).—Fuller's earth is being mined at Olmstead, Ill. for use in the bleaching of oils. The total amt. available is estd. at 4 million tons, and its advantageous location will probably make it comp. important. Edw. F. Holden (*C. A.*)

11. **Centrifugal decantation.** R. Berline. *Chimie & industrie*, **6**, 737–45(1921).—An outline of the theory of centrifugal decantation with a brief description of various types of comp. app. A. P.-C. (*C. A.*)

12. **Industrial research and patents.** C. L. Jenks. *Chem. Met. Eng.*, **26**, 394–7 (1922). E. H. (*C. A.*)

13. **Corrosion of a producer-gas cooling system.** Lloyd E. Jackson. *Chem. Met. Eng.*, **26**, 60–4(1922).—The system consisted of dust catchers, collecting mains and condensers, into all of which cooling water was sprayed. The water was caught in a decanter, pumped 550 ft. to spray ponds, passed through a coke filter and pumped back through the system. Make-up water was added from the Providence city mains. After 6 mos. operation leaks appeared, especially in the 550 ft. main to the spray pond. The hot water in this main was acid and contained suspended coke dust. Tests showed that while the life of this 6 in. main under corrosion alone would be 10 yrs., erosion from the coke dust reduced it to 9 mos. Remedies suggested were: (1) To use fresh cooling water from wells and waste it into the bay after it went through the system once. (2) To use brackish water from the bay in the same way. (3) To recirculate fresh cooling water after filtering out the coke dust and treating with lime for acidity and with iron turnings for dissolved O. The results of numerous expts. are given and the suggested remedies discussed, but there is given no final conclusion as to which remedy was or should be adopted. J. J. Morgan (*C. A.*)

14. **The Santa Barbara 500-ton mill for concentrating lead carbonate ores.** F. M. Heidelberg. *Eng. Mining J.*, **112**, 1050–7(1921).—A description of the new mill of the American Smelters Securities Co. at Santa Barbara, Chihuahua, Mexico, with flow sheets and detailed data on equipment. Au and Ag are present in small but paying amt. A. Butts (*C. A.*)

15. **Comparison between laboratory fuel tests and practical working results of the producer-gas process.** N. E. Rambush. *J. Soc. Chem. Ind.*, **40**, 293–300T(1921); cf. *C. A.*, **15**, 2981.—R. describes a method and app. for detg. in the lab. the practical tar yield of fuels and gives the results obtained on the same fuel in the lab. and on large-scale gasification. The ordinary fuel analysis, especially in regard to the volatile content detn., is generally insufficient to predict the gasification products. Such a process as the one described should predict with reasonable accuracy the thermal efficiency, the quality of the gas, the possible yield of by-products such as tar and NH_3 from particular coals, as well as the type of plant to be employed. The app. consists primarily of a simple horizontal distn. retort with a condensation and absorption train. Two kg. of fuel are distd. gradually up to 800° from 4–6 hr. and the amt. and compn. of the distillate detd. by the usual methods. Data from a no. of expts. are given and compared with results obtained on actual producer plants and the relationship is shown to be very close. It is concluded that a tar recovery, in practice, of 80% could be obtained, and also it should be possible to det. the heating value of the gas from a particular coal by observing the relation between the coke gasification efficiency and the gas heating value. Fuels of fine grading require large gasification areas, and those of high-caking properties to be stirred mechanically, those of high ash content mech. grates, while those of high tar yield should be gasified at low temps. to give the highest yield of light tar oils, and those with high moisture content require a deep fuel bed in order to properly utilize the sensible heat of the gases. Fuels with high volatile content show thermal decompn. upon distn., such heat would, however, not be lost for the purpose of producer-gas production. J. L. Wiley (*C. A.*)

16. Twenty-eighth annual report of the Committee on Atomic Weights. Determinations published during 1921. G. P. Baxter. *J. Am. Chem. Soc.*, **44**, 427–37(1922); cf. *C. A.*, **15**, 1095.—Detns. on B, O, F, Cl, Ni, Zn, Ge, Cd, Sb, La and Bi are reviewed. E. J. C. (*C. A.*)

17. Investment in chemical education in the United States, 1920-1921. C. J. West and Callie Hull. *J. Ind. Eng. Chem.*, **14**, 237(1922). E. J. C. (*C. A.*)

18. Auxiliary electrochemical developments for hydroelectric plants. H. K. Benson. *Chem. Met. Eng.*, **25**, 1004(1921).—Of the chem. processes utilizing elec. power only a few are capable of operating intermittently on the off-peak power of a municipal hydroelec. plant. As a means for increasing the load factor of the new Skagit power plant at Seattle, Wash., the following process are preferred in the order given: the elec. are fixation of N; the electrochem. production of P_2O_5; the production of electrolytic H and O (in the event of the nearby location of a hydrogenation industry this process would rank second if not first); the production of NaOH or org. chemicals.

Louis Jordan (*C. A.*)

PATENTS

19. Ceramic vessel. Frederick S. Lowry. U. S. 1,400,489, Dec. 13, 1921. A ceramic vessel consisting of a body structure composed of compositely united inner and outer layers; the outer layer is composed of a mixt. of fire-clay, sand, manganese, and water suitably molded into receptacle form; the interior layer is composed of fire-clay, and water, the inner layer serving to impart a smooth finish to the interior of the vessel so that a glaze may be applied thereto. C. M. Saeger, Jr.

20. Condenser for shale-oil, etc. J. A. Bishop. U. S. 1,395,898, Nov. 1. Vapor to be condensed is passed through staggered vertical pipes cooled by air passed horizontally around them. The air is cooled by contact with H_2O-cooled brick walls. (*C. A.*)

21. Plastic composition and process for making the same. Reiman G. Erwin. U. S. 1,409,088, March 7, 1922. A compn. of matter comprising mineral dust of colloidal nature suspended in bitumen and combined with sodium chloride, sodium sulphate and sulfur derivatives in the following propns.: of dust and the above mentioned chemicals 40 to 60%, of bitumen 40 to 60% and an aggregate comprising mineral particles; 40 to 60% of such aggregate are suspended in from 60 to 40% of the bituminous compn. C. M. Saeger, Jr.

22. Plastic-block mold. Ernest John Benson. U. S. 1,408,685, March 7, 1922. A block mold comprising a rear end wall; side walls hingedly connected to the rear end wall for outward swinging movement; groove-forming members secured to the confronting sides of the side walls and each comprising a flexible tubular member; a rod for securing the member in position upon the wall; a front end wall detachably secured to and spanning the side walls; duct forming members secured to the inner sides of the front end wall, each of these comprising a core and a jacket embracing the core.

C. M. Saeger, Jr.

Apparatus and Instruments

23. Apparatus for electrically heating liquid and solid chemicals. Anon. *Engineering*, **92**, 852(1921).—In a resistance type of heater, an a. c. is passed through the liquid to be heated, which flows down a cascade or step-ladder effect. The heat is controlled by alteration of the cross-section or length of the stream, or of the applied voltage; single- or 3-phase current may be used. Solid chemicals may be heated in an induction type of app., in which coils carrying an a. c. are arranged in such a relation to the surface with which the chemical is in contact that the induced current and hysteresis effect in it generate the necessary heat; temp. control is effected by regulation of the current.

This latter app. has been applied to rotary and drum driers, shelf driers, hot grinding pans, pumps, and delivery pipes. T. S. Carswell (*C. A.*)

24. **Recessed plate and plate and frame filter presses: their construction and use.** E. A. Alliott. *J. Soc. Chem. Ind.*, **39**, 261–85T(1920).—This paper gives a detailed study of the construction and meaning of the many variations in type of filter presses, their use and data incident to operation including large scale operation figures. A given material varies greatly in filtering qualities because of slight variations in mfg. processes. The problem is hence very difficult and diverse. In the recessed plate press, the rims of the plate are raised so that a hollow chamber is formed when 2 plates are brought together. The feed passage is through the body of the plate and cloth is laid over each side. This type is the least expensive and requires less labor. It is suitable for cakes from 1 to 2 ins., depending on the size of the press. The second type of press is especially suited to the formation of very thick filter cakes or for filtering materials that tend to rot the cloth, for the plates are flat, the chambers being formed by placing hollow frames between the plates and the cloth therefore lies flat on the plates. In this press, filter paper can also be used. This type is not suitable for thin cakes or lumpy material because the feed openings which are through the rims of the frames are often very small. The plates of filters may be made of wood, iron, vulcanite (for strong HCl), etc. The best woods for strong acids are coniferous. Oak is best for CH_3COOH. Impregnation of the wood is of doubtful value as far as increasing its resistance to acids. Cocks are preferable to valves which, if used, should be of a kind easily cleaned. Small batches may be filtered in a large press by making use of a dead plate. The simplest closing gear (center screw pattern) is the most satisfactory. A. gives special facilities for the care of the cloth and advises the use of a pulp cake for filtering liquors contg. small quantities of fine ppt. For recessed plate type, double cloths are used and various methods of application of the cloth to the press are detailed. The design of the filter press depends upon a number of factors, chief among which are: quantity to be filtered, chem. properties, suitable cake thickness, working pressures, cloth, time required or rate, size of particle, etc. Tests on a small scale are run to get basic data. All of these factors are taken up mathematically, formulas being derived and curves being drawn covering not only the design and proper working and operation, but also the feed and washing and economical aspects including labor. The paper is exceptionally clear and detailed and is profusely illustrated with drawings, photographs, and photomicrographs. P. D. V. Manning (*C. A.*)

25. **Electric heat for thermal processes.** E. F. Collins. *J. Ind. Eng. Chem.*, **14**, 101–4(1922).—An oven for baking automobile engine cores gave an efficiency of 11.6 lbs. of cores per kw.-hr. Japanning ovens are in use requiring over 3000 kw. to heat and turning out one automobile per min. Electrically heated glass annealing ovens show 20% lower cost than gas-heated lehrs. The muffled arc type of elec. furnace will melt 1500 lbs. of brass per hr., with a metal loss of less than 1.5% and a power consumption of not more than 270 kw.-hrs. per ton. Cu is melted at the rate of 1300 lbs. per hr. at 350 kw.-hrs. per ton. Other applications are in baking vitreous enamels, cartridge unit-heaters and glue melting pots. Also in *Beama*, **10**, Pt. 2, 3–25(1921). A. C. Langmuir (*C. A.*)

26. **New Brown cold junction compensated pyrometer.** Anon. *Chem. Met. Eng.*, **25**, 757–8(1921).—The cold junction of the thermocouple is brought to the pyrometer box; a Briguet spiral (compound strip of 2 metals of different coeffs. of expansion) is mounted on the moving member so that as the reading due to the difference between the temp. of the two junctions decreases with increasing temp. of the cold junction, the zero reading of the pointer is advanced. In this way the true temp. reading is obtained irrespective of the temp. of the cold junction. A smaller pointer actuated

directly by the Briguet spiral establishes the zero point of the instrument to allow resetting when necessitated by jars or by long service. DONALD W. MACARDLE (*C. A.*)

27. Setting a recording pyrometer for cold-junction temperature. KIRTLAND MARSH. New Kensington, Pa. *Chem. Met. Eng.*, **24**, 1152(1921).—In the case where the galvanometer scale does not come down to the cold-junction temp., the pointer is set for any convenient low temp., A, then, by an adjustable small e. m. f., is deflected by an amt. $A - C$, where C is the cold-junction temp., and then set to A while the small e. m. f. continues to be applied. On open circuit the pointer, though off scale, now reads C, which is the necessary adjustment. W. P. WHITE (*C. A.*)

28. Pyrometry. Color temperature and brightness of various illuminants. E. P. HYDE AND W. E. FORSYTHE. *Trans. I. E. S.*, **16**, No. 8, 419–30(1921).—Color temps. for many light sources are given including:

Gas flame—batswing	2160°C
Gas flame candle shape	1875
Sperm candle	1930
Paraffin candle	1925
Standard Pentane Lamp 10 C. P.	1920
Flat wick kerosene lamp	2055
Round wick kerosene lamp	1920
4. w. p. c. carbon	2080
3.1 w. p. c. treated carbon	2165
2. w. p. c. osmium	2185
2. w. p. c. tantalum	2260
Acetylene as a whole	2380
One spot acetylene	2465
Mees burner	2360
1.25 w. p. c. tungsten	2400
2.3 w. p. c. Nernst	2400
Sun outside atmosphere	6500°
Sun at earth's surface	5600

WM. M. CLARK

PATENTS

29. Drying apparatus. M. MOMOTANI. Jap. 37,903, Jan. 26, 1921. A conical vessel, in which spiral stairs are fixed, is provided with an elec. heater and drier for air. Materials are charged from the top; dried air is introduced from the bottom. (*C. A.*)

30. Viscosimeter. H. N. MOODY. U. S. 1,405,538, Feb. 7. (*C. A.*)

31. Gas-analysis apparatus. E. H. DELANY AND S. H. PAYNE. U. S. 1,395,560, Nov. 1. Gas to be tested, *e. g.*, flue gases for CO_2 detn., are passed into a liquid absorbent such as NaOH soln. in a tower provided at its top with gages for registering differences in pressure caused by the absorption. (*C. A.*)

32. Thermocouple. M. A. HUNTER. U. S. 1,393,375, Oct. 11. A thermocouple is formed of 2 elements producing, when heated, or cooled, a substantially linear e. m. f.-temp. curve; one of the elements is an alloy of Cu 50–75, Ni 50–25 and Cr 5–30 parts which is refractory and highly resistant to oxidation and the other element is an alloy of Ni 100 with Cr 10 parts. (*C. A.*)

Chemistry, Physics and Geology

33. Brick testing by the Brinnel Ball Method of Le Chatelier and Bogitch. *Rev. Mat. Constr. Trav. Pub.*, 147, 240(1921).—(Read before the French and Belgian members of the I. A. T. M. by Mr. Guillery.) A ball 17.5 mm. in diam. is sunk onto a test brick

covered with a leaf of tinsel $^1/_{10}$ mm. thick, that has been blackened with hydrogen sulphide. Oblique jamming is prevented by ball bearings. A constant pressure of 500 kgs. for 1 min. leaves an imprint on the foil, the diam. of the impression being an indication of the brick's resistance. The method is rapid, sensitive and leaves the brick practically unaffected. LOUIS NAVIAS

34. Temperature coefficients of the electrical conductance of pure metals. L. HOLBORN. *Seit. für Physik.*, **8**, No. 1, 58–61(1921).—The observed values for heated metals between 0° and 100° are given below.

Ni	0.675	Rh	0.443	Ir	0.411
Co	0.658	Mo	0.435	Ag	0.410
Fe	0.657	Cu	0.433	Au	0.400
W	0.465	Cd	0.424	Pt	0.392
Bi	0.446	Pb	0.422	Pd	0.377
Al	0.445	Zn	0.415	Ta	0.347

WM. M. CLARK

35. Particle-size analysis of granular and powdered materials. FERET. *Rev. Mat. Constr. Trav. Pub.*, **147**, 237–39(1921).—(Read before the French and Belgian members of the International Association for Testing Materials.) F. describes and criticizes generally three methods of sepg. a material into divisions according to sizes of particles, namely for wet sepns., by sedimentation and by levigation, and for dry sepns. by currents of gas. F. has proposed a classification of particles according to sizes, which he submits to the Association and to the permanent Commission of Standardization with the hope that it will become international. The group names are the French names which F. has coined from the words given in parenthesis after them. The numbers refer to the max. and minimum dimensions for any group in mms.:—Primary Groups, "Nucles" (**nucleus**) 100–10; "Granes" (**granum**) 10–1; "Rugues" (**rugatus**) 1–0.1; "Pulvres" (**pulvis**) 0.100–0.010; "Plastes" (**plasticity**) 0.010–0.001; "Moves" (**movere**) 0.0010–0.0001. (The last group showing Brownian movement.) Each primary group is divided into three secondary groups, having the prefixes "mega," "meso" and "micro," which refer to the 10–5, 5–2, and 2–1 parts of each primary group respectively, thus:—"megaplastes" (0.010–0.005), "mesoplastes" (0.005–0.002), "microplastes" (0.002–0.001). LOUIS NAVIAS

36. Japanese acid clay (fuller's earth), its properties, chemical applications and the relation to the geological formation of petroleum. KIUHEI KOBAYASHI. *Kôjin Kwagaku Zasshi* (*Eng. Chem. J.*), **1**, 15–23(1921).—A summary of the properties of the clay, the place of production, its applications in the chem. industries, and its relation to the geol. formation of Japanese petroleum. Cf. *Jour. Am. Ceram. Soc.*, **4**, 503(1921). K. K. (*C. A.*)

37. The physical chemistry of the crystallization and magmatic differentiation of igneous rocks. III. J. H. L. VOGT. *J. Geology*, **29**, 515–39(1921); cf. *C. A.* **15**, 2813, 3808.—This section is devoted largely to the discussion of the difference between the soly. of the ferromagnesian silicates in acid and basic magmas. W. F. H. (*C. A.*)

38. Note on the green color of tungsten trioxide WO_3. J. A. M. v. LIEMPT. *Z. anorg. allgem. Chem.*, **119**, 310–12(1921).—The green color is due to a slight reduction of WO_3, probably to W_2O_5. This was shown by mixing samples of WO_3 with 1% of oxalic acid and allowing to stand a week in the light and in the dark. The reduction goes on more rapidly in the light and the presence of 1% of W_2O_5 or less will account for the green color. The conclusion is that the green color is probably due to the reduction by org. matter, *i. e.*, dust, and is furthered by light. P. E. BROWNING (*C. A.*)

39. Merwinite, a new calcium magnesium orthosilicate from Crestmore, California. ESPER S. LARSEN AND WILLIAM F. FOSHAG. Wash., D. C. *Am. Mineral.*, **6**, 143–8

(1921).—This mineral, which is named after H. E. Merwin, occurs in abundance in metamorphic limestone, having previously been mistaken for monticellite. It is intimately associated with spurrite and an unidentified mineral, called "A." It is apparently monoclinic, showing polysynthetic twinning and has $\alpha = 1.708$, $\beta = 1.711$, $\gamma = 1.718$, sign + and $2V = 66\frac{1}{2}°$. There is perfect cleavage on (010); H. = 6, sp. gr. = 3.150; colorless to pale greenish, with vitreous luster, or greasy when intimately mixed with the other minerals. Material for analysis was sepd. with heavy solns., and was found under the microscope to contain less than 2% of admixture. It dissolves in HCl and gelatinizes. Analysis gave: SiO_2 35.50, 35.84, Al_2O_3 0.66, FeO_3 none, CaO 49.96, 49.70, MgO 11.62, FeO 1.23, loss at 110° 0.12, ign. 0.94 (part of the last 2 items being bromoform used in sepn.) sum 100.02%. This corresponds closely with 3 $CaO.MgO.2SiO_2$ or $Ca_3Mg(SiO_4)_2$. It alters readily to secondary minerals often appearing as a white coating or crack filling; one of them, thaumasite, has already been described (*C. A.*, **14**, 1948). The compd. does not appear in any of the CaO-MgO-SiO_2 systems which have been studied thermally, and is probably a low temp. form, breaking down below its m. p. Its association with wollastonite shows it to have crystd. below 1190°, but its occurrence suggests still lower temps. It is not closely related to any known mineral, differing from the olivine group in crystn. E. T. W. (*C. A.*)

Refractories and Furnaces

40. Eastern Steel Company new blast furnace. Richard Peters, Jr. *Blast Furnace Steel Plant*, **10**, 113–6(1922). E. J. C. (*C. A.*)

41. Discussion on the disintegration of blast-furnace linings. R. M. Howe. *Blast Furnace Steel Plant*, **10**, 161–3(1922).—Analyses are given of deteriorated linings in which no Zn was found, although the action of the linings was similar to those before. There was an increase in potash, carbon and other substances. Cf. F. W. Lurmann, *Stahl u. Eisen*, **18**, 168(1917); E. Firmstone, *Trans. Am. Inst. Mech. Eng.*, **34**, 437(1903); Bernhard Osann, *Stahl u. Eisen*, **23**, 823(1903); R. M. Howe, *Bull. Am. Inst. Mech. Eng.*, **1920**, 5. W. A. Mueller (*C. A.*)

42. Disintegration of blast-furnace linings. P. O. Menke. *Blast Furnace Steel Plant*, **10**, 116–8(1922).—Experience at the Shenango Furnace Co. plant, Sharpeville, Pa. shows that in a number of cases, furnace linings have so expanded as to cause bursting of the furnace shells. These linings were ordinarily found to be vitrified and of good character for a penetration of 2–4 in., then a softening of the brick took place which often carried to within 4 or 5 in. of the outer steel shell. The deterioration was to such an extent as to make the removal of the lining possible by hands when the vitrified portion had once been removed. This "softened" portion contained up to 50% Zn in the form of both oxide and metal. The make of brick, whether hand made or steam pressed makes no difference in this penetration action of the zinc. The action of the Zn seems to be cumulative and even with small amts. this takes place.
W. A. Mueller (*C. A.*)

43. A type of natural draft melting furnace. II. Chas. Vickers. *Brass World*, **18**, 49–52(1922); cf. *C. A.*, **15**, 3061.—Detailed erecting directions are given. For brass melting furnaces, bricks of medium coarse grain with a good strong burn are best. The six standard shapes of fire-brick and stack construction are discussed.
W. H. Boynton (*C. A.*)

44. The preparation of zirconia from Brazilian ore and a new method of determination. E. C. Rossiter and P. H. Sanders. *J. Soc. Chem. Ind.*, **40**, 70–2T(1921).—Soln. of Brazilian ore is best effected by fusion of ore ground to flour fineness with an equal quantity of NaOH in an Fe crucible with continuous stirring until the mass be-

comes granular, after which the heat is maintained at dull redness for 2 hrs. The fused mass is extd. with water, then with HCl. The insol. residue equals about 20% of the ore and contains: 61.55% ZrO_2, 29.32% SiO_2, 1.10% Fe_2O_3, 1.80% Al_2O_3, 5.90% loss on ignition. The soln. contains Zr oxychloride, Fe, Al, Ti, Mn, etc. It is dild., treated with satd. SO_2 soln. and heated to boiling. Sufficient N H_2SO_4 is added to replace the Cl in the oxychloride; Zr is deposited as basic sulfate, easy to filter, though very bulky. It is washed by decantation. ZrO_2 recovery is made by drying and igniting, or by suspending in water, treating with alkali, washing, drying and igniting the hydroxide. The ZrO_2 contains 98–99% ZrO_2, some SiO_2 and Al_2O_3 and less than 1 part of Fe in 100,000. Properties of the basic sulfate and oxychloride are given. To det. of ZrO_2 in presence of Fe and Al 7 cc. H_2SO_3 and 2 cc. H_2SO_4 are used for each 0.2 g. of ZrO_2. The soln. should be dild. to 150 cc. for each 2 cc. of H_2SO_4. Difficulty due to formation of H_2SO_4 in the reaction is overcome by boiling, after the addition of SO_2 soln. until Fe is completely reduced. Complete separation from Fe_2O_3 is obtained in proportions up to 1 : $3\frac{1}{2}$ but, with larger proportions of Fe the basic sulfate is slightly soln. in the $(NH_4)_2SO_4$ and NH_4Cl formed during neutralization. W. H. B. (*C. A.*)

45. Fusibility of open-hearth slag containing titanium dioxide. GEO. F. COMSTOCK. *Chem. Met. Eng.*, **26**, 165–6(1922).—Basic open-hearth furnace slags varied in solidifying point from 1085° to 1385° but in both cases the addn. of TiO_2 lowered the fusion point. The amt. added was at first 0.33% to correspond to the quantity which the usual addn. of 3 lbs. of Fe-Ti per ton of steel might bring into the slag. It had no distinct effect. 1.33% and 2.67% gave solidification points of 1055° and 1025°, resp., with the more fusible slag. The less fusible slag had its softening point lowered 80° by 2.67% TiO_2. TiO_2 makes basic open-hearth slag more fusible whether oxidizing or reducing conditions prevail. JAS. O. HANDY (*C. A.*)

PATENTS

46. Furnace and method of conveying materials. HARRY P. MCCANN. U. S. 1,400,367, Dec. 13, 1921. In a fur. heated by gases of combustion, a heating chamber with a hearth having a longitudinal slot therein and a work-moving member disposed in the slot; the slot is wider than the work-moving member which forms clearance spaces between the work-moving member and the walls of the slot; a flue in the hearth connected to the slot conducts the waste gases of combustion away from it. C. M. S., JR.

47. Basic refractory brick. SPENCER B. NEWBERRY. U. S. 1,400,087, Dec. 13, 1921. The process of making basic refrac. brick by calcining a mixt. of lime and argillaceous matter in such proportions that the resulting clinker will not disintegrate after long-continued heating or an exposure to air; adding to the clinker a mixt. of lime and argillaceous matter of greater fusibility than the clinker; molding the mixt. into blocks and burning the blocks at approx. the temp. used in burning ordinary fire-brick. C. M. SAEGER, JR.

48. System of kilns. LEROY WEEKS. U. S. 1,404,412, Jan. 24, 1922. A pair of kilns, each being equipped with an annular heat chamber disposed in the walls of the kiln, above the surface of the ground; a subterranean passage from one kiln has its outlet disposed between the two kilns; a flue communicates with the outlet of the subterranean passage and with the heat chamber of one of the kilns through the side wall thereof. C. M. SAEGER, JR.

49. Apparatus for burning bricks. WILLIAM WALLACE DICKINSON, JR. U. S. 1,403,300, Jan. 10, 1922. Apparatus for burning bricks comprising, in combination, a traveling crane, a row of kilns located beneath the crane (the kilns having a scoving consisting of rectangular panels of heat resistant material), and means carried by the crane whereby the panels may be transported bodily from kiln to kiln. C. M. SAEGER, JR.

50. Apparatus for burning bricks. William Wallace Dickinson, Jr. U. S. 1,403,301, Jan 10, 1922. A row of brick kilns combining an automatic coal stoking device movably supported at each side of the row and adapted to be presented to the kilns successively in heating relation. C. M. Saeger, Jr.

51. Tunnel-kiln. George W. Booth. Canada 1,403,734, Jan. 17, 1922. A tunnel kiln has an air space formed in its walls extending longitudinally of the preheating, firing and cooling zones of the kiln; a fur. communicates with the interior of the firing zone of the tunnel adjacent the cooling zone; a stack adjacent the inlet end of the preheating zone; a flue communicates with the interior of the firing zone of the tunnel and extends along the preheating zone of the fur. to the stack; a flue forms a communication between the stack and the air space aforesaid adjacent the inlet end of the tunnel. C. M. Saeger, Jr.

52. Rotary kiln. Johan Sigismund Fasting. Denmark 1,404,381, Jan. 24, 1921. A rotary kiln with a clinker cooling device includes an annular chamber concentric with the kiln; it is open at one end and communicates at the other end with a chamber at the end of the kiln and into which the clinker is discharged; the clinker travels through this chamber longitudinally. Means is provided to introduce into the open end of the annular chamber cooling air in excess of that required for combustion in the kiln; the escape of an excess of air from the chamber at the end of the kiln is also provided. C. M. Saeger, Jr.

53. Kiln furnace. Frank M. Marris. U. S. 1,407,288, Feb. 21, 1922. The combination of a kiln with fuel and draft openings having a single integral frame and openings corresponding with the fuel and draft openings; a vertically pivoted auxiliary door inside of the vertically pivoted door; means actuated by opening the vertically pivoted door for swinging the lower edge of the horizontally pivoted door outward. C. M. Saeger, Jr.

54. Continuous kiln. Walter G. De Steigner. U. S. 1,407,192, Feb. 21, 1922. The combination in a continuous kiln having a substantially horizontal middle portion and downwardly directed end portions; means for moving a series of mechanically unconnected and separated articles to be treated by intermittent successive steps up one end portion across the middle portion and down the other end portion; means for independently supporting the separated articles during the interval between stepped movements. C. M. Saeger, Jr.

55. Furnace roofs. H. L. Charles. U. S. 1,394,470, Oct. 18. An integral structure of highly refractory material such as a SiO_2, lime, fire-clay, MgO or chromite compn. is molded over the fire-brick arched roof of furnaces such as reverberatory smelting furnaces and is baked by the action of the furnace gases. (*C. A.*)

56. Refractory article of magnesia and alumina. R. C. Purdy, M. F. Beecher and A. A. Klein. U. S. 1,394,442, Oct. 18. A bonded material suitable for lining furnaces or making refractory receptacles is prepd. by mixing pre-shrunk granules of one of the ingredients, MgO or Al_2O_3, with the other of these 2 ingredients in finely divided condition and heating the mixt. to a temp. somewhat below the m. p. of any eutectic of the MgO-Al_2O_3 system to effect bonding. (*C. A.*)

57. Rendering furnace walls impervious to gases. C. M. Shipman. U. S. 1,387,739, Aug. 16. Furnace walls are rendered impervious to the passage of hot combustion gases by treating the walls with a slurry formed of clay, SiO_2 and sol. silicate and then exposing the treated walls to hot combustion gases. (*C. A.*)

58. Dry gas-cleaning tower. F. R. McGee and G. W. Vreeland. U. S. 1,396,767, Nov. 15. The tower comprises superposed dry cleaning and filtering chambers having filtering mats with vibrating mechanism to clean the mats. (*C. A.*)

59. Oven adapted for burning ceramic ware. S. Troop. U. S. 1,393,650, Oct.

11. The oven has a long heating chamber through which the articles to be heated are carried and comprises zones of approx. uniform temp. with intermediate zones of changing temp. The oven may be heated by gas or other fuel. (*C. A.*)

60. **Heating blocks for fireless cookers.** E. T. Young. U. S. 1,391,037, Sept. 20. Blocks which have the heat-retaining qualities of soapstone are formed by blending kaolin with a pulverized fired kaolin and firing the mixt. at a high temp. Equal amts. of No. 9 Edgar's ball clay and No. 15 mesh fire-brick grog may be used, fired to cone No. 7. (*C. A.*)

61. **Blowpipe adapted for heating, welding or cutting.** G. L. Walker. U. S. 1,395,537, Nov. 1.

Abrasives

PATENT

62. **Abrasive for grinding and smoothing glass.** W. L. Kann. U. S. 1,387,649, Aug. 16. Glass is ground and smoothed preparatory to polishing by the action of particles of cryst. or similar abrasive material which is broken down into successively smaller and smaller cryst. particles during the grinding and smoothing operations. (*C. A.*)

Stoneware, Whiteware and Porcelain

63. **Scumming of whiteware and the peeling off of glazes.** Anon. *Sprechsaal*, **54**, 429(1921).—In whiteware there is often a tendency for the glaze to peel off especially along the edges. This is due to sol. sulphates which are more abundant along the edges than other places. This scum prevents the glaze from sticking to the body and hence the glaze has a tendency to peel. By the use of $BaCl_2$ or $BaCO_3$ the scumming and hence the peeling of the glaze may be prevented. H. G. Schurecht

64. **The insulation of high-voltage transmission lines. Conception of a million volt line.** F. W. Peek, Jr. *Gen. Elec. Rev.*, **25**, 111–9(1922).—Porcelain is the only material available at present for high potential insulators. C. G. F. (*C. A.*)

BOOK

65. **Die Porzellan-Isolatoren.** G. Benischke. Berlin: Julius Springer. 94 pp. M 24. **Die Geschichte der Porzellanfabrik zu Tettau.** Leipzig: Eulen-Verlag. 64 pp. M 10. (*C. A.*)

PATENT

66. **Mixture for making bricks.** J. Smith. U. S. 1,385,757, July 26. A mixt. for brick making is formed of cement, coal ashes and brick dust in about equal amts. (*C. A.*)

Heavy Clay Products

PATENTS

67. **Building tile and wall made therefrom.** Leonard H. De Fernelmont. U. S. 1,409,284, March 14, 1922. A wall composed of a plurality of tiles directly interlocked both in a vertical direction by immediate contact and in a lateral direction by means of ribbed and grooved interengaging parts on the respective adjacent edges of the abutting tiles; the adjacent edges on each side of the interlocking portions of abutting tiles are provided with grooves, the grooves outwardly flaring and opening on the faces of the wall and between the abutting tiles; cement fills the grooves to form a sealed joint between the tiles and a smooth outer continuous surface in the plane of the tiles and holds the tiles from tilting out of their common plane of alignment. C. M. S., Jr.

68. **Open-end hollow tile for wall structures.** Mathias Dochnal. U. S. 1,406,354, Feb. 14, 1922. A building tile for wall structures comprising an inner wall section

and an outer wall section, and a pair of spaced cross-walls which unite the inner and outer wall sections; each of the cross-walls have concaved faces which form a circular central opening in the tile and a semi-circular opening at each end of the tile; a pair of opposed ribs, which extend into the central opening from the inner and outer wall sections, the ribs each having a beveled inner face uniting with the concaved faces of the cross-walls to strengthen the inner and outer wall sections midway their length; facial ribs are arranged in opposed relation at the extremities of the inner and outer wall sections and each of the ribs have a beveled inner face terminating with the ends of the concaved faces of the cross-walls. C. M. Saeger, Jr.

69. Wall construction and brick therefor. Robert F. Martin. U. S. 1,400,893, Dec. 20, 1921. A brick for wall construction comprising a solid face portion; an inner portion of spaced-end sections constituting with the face portion the wall-supporting portions of the brick; an intermediate portion comprising a lateral web which connects the end sections intermediately with their upper and lower surfaces, and provided intermediately between its longitudinal edges and its upper and lower sides with relatively narrow non-mortar receiving ribs. C. M. Saeger, Jr.

70. Drier for use in the manufacture of articles from tender clay. Thomas L. Myers. U. S. 1,403,440, Jan. 10, 1922. Drying app. of the kind described for use in drying articles of tender clay. This consists (1) in a drying room, a plurality of tracks therein to receive the trucks loaded with clay articles to be dried, (2) means to radiate heat to the clay articles on the trucks without air current drying tunnels; (3) means over which the trucks are thereafter moved to the drying tunnels for complete drying in a current of heated air. C. M. Saeger, Jr.

71. Tool for handling tiles. Albert A. Clymer. U. S. 1,401,046. Dec. 20, 1921. A tile rolling tool with a handle and with long arms which are practically straight and parallel to each other and some distance from each other. These arms extend laterally. They have bearing surfaces to permit the tile to roll while engaged by the tool, one of the arms being adjustable relatively to the other arm for the purpose specified; the handle is bent intermediate to its end to provide the first arm, the adjustable arm has a socket; the sockets are slidably engaged with the handle, and individual means to secure the sockets to the handle. C. M. Saeger, Jr.

72. Automatic tile-cutter. Noel C. Whitney. U. S. 1,400,473, Dec. 13, 1921. In a machine for the purpose specified, there is a combination of a pair of endless carriers arranged side by side with their inner runs parallel; a series of supporting members mounted on the carriers; when on the adjacent runs of the carrier these members support the material being operated upon; a series of cutting devices mounted on the carriers and adapted to operate upon the material is supported by the members during the travel thereof. C. M. Saeger, Jr.

73. Building block. Arthur G. Hatch. U. S. 1,408,733, March 7, 1922. A building block which has a plane face, the opposite face carrying convex cylindric flanges adjacent to the opposite edges of the block; the axis of the cylindric of the flanges are parallel to the plane face and parallel to the adjacent edge of the block. C. M. Saeger, Jr.

74. Arch-brick. Alfred H. Willet. U. S. 1,401,022, Dec. 20, 1921. A pair of brick members each having support-engaging parts and brick engaging parts at opposite ends; the brick engaging parts are substantially counterpart and substantially complementary and arranged with respect to each other; the support engaging parts make the brick members variable as to effective length to fit different spacings of supports; the brick engaging portions coöperating to provide reciprocal support for the adjacent ends of the members throughout the range of adjustment. C. M. Saeger, Jr.

Glass

75. Historic optical glasses. P. Nicolardot. *Le Verre*, **2**, 29–32 (1922).—Dollard in 1755 made the first achromatic combination for a lens, using crown and flint glasses. This new use for flint glasses caused a demand for homogeneous heavy lead glasses, with the result that a number of men attempted to make them. Prizes offered by the (French) Academy of Sciences helped to sustain interest. Much credit is due to Pierre-Louis Guinand who made radical changes in the methods of making optical glass in his day. Among other improvements was the introduction of stirring. This was accomplished by stirring the molten glass with a clay thimble thus insuring a glass having the same index of refraction throughout. About 1805 Fraunhofer and Guinand worked together at Benedictbeuren. Later Guinand's son and Bontemps divided the prize given by the (French) Society for the Encouragement of National Industry, for having perfected a method of producing good quality flint glass on a commercial scale. Both men used the methods of the elder Guinand. Through the younger Guinand and Bontemps there have been developed two of the large modern European firms making optical glass. From Guinand through a number of partnerships has resulted the French firm of Mantois, now known as Parra. Bontemps, for political reasons, was obliged to leave France, and in 1848 he joined the Chance firm in England, introducing to them the methods of making optical glass. The German firm, Schott, founded in 1882, without doubt followed Guinand's methods. Louis Navias

76. Lime in glass batches. Anon. *Pottery Gazette and Glass Trade Review, The Glass Worker*, **41**, No. 26, 11–12 (discussion at meeting).—Action depends on form of alkali and form of lime used and ratio of lime to soda. In tanks using 8% lime, soda-ash-burnt-lime melts fastest and saltcake-burnt-lime melts slowest. In 12% lime glass, slaked-lime with either soda-ash or saltcake or both, melts fastest. Small amounts of magnesia aids melting. R. J. Montgomery

77. Use of cullet in melting glass. Anon. *Pottery Gazette and Glass Trade Review, The Glass Worker*, **41**, No. 26, 12 (discussion at meeting).—Up to 50% cullet aided in melting, plaining and uniformity. Above this amount, glass is hard to free from bubbles. 33% recommended. R. J. Montgomery

78. Glass decoration (lecture before the "British Pottery and Glass Trades"). J. T. Fereday. *The Glass Worker*, **41**, No. 26, 18.—General method of cutting, engraving, intaglio and cameo cutting, etching and color decoration is given. R. J. Montgomery

79. Action of metallic lead in pots. Henry W. Hess. *The Glass Worker*, **41**, No. 28, 14.—Metallic lead was put in a pot holding 150 lbs. of litharge batch. The melt was clear, there was no action on the pot bottom and no trace of metallic lead in the glass. Six trials gave the same result. R. J. Montgomery

80. Liquid inclusions in glass. Charles E. Benham. *Geol. Mag.*, (March) **1922**; *Nature*, **1922**, April 8, 456, **1922**.—A glass tube about 3″ long and $^1/_4$″ external diam. was partly filled with water and sealed. It was enclosed within an unbaked brick and fired in a brick kiln at about 1200°C. After this treatment the glass was found to contain microscopic liquid inclusions with vapor bubbles comparable to those found in quartz. Wm. M. Clark

81. Dispersion in optical glasses. III. F. E. Wright. *J. Optical Soc. Am.*, **5**, 389–97(1921); cf. *C. A.*, **14**, 3135; **15**, 2343.—A table is given based on the conclusions of the 2 previous articles from which by arithmetical interpolation the mean dispersion and the corresponding partial dispersions can be read off directly to the 5th decimal place. The table is tested by series of fluor crowns, borosilicate crowns, barium crowns, flints, borosilicate flints, and barium flints. The errors found are commonly restricted to the 5th decimal place. "The chief optical differences in glasses are not differences in

the character of the dispersion, but in the fact that 2 glasses may have the same dispersion relations and yet have appreciably different abs. refractive indices. In a dispersion formula both refringence and dispersion should be specifically recognized; the first as a const. giving the datum level of refringence and the second as a function of one or more terms expressing the run of dispersion throughout the visible spectrum. These conclusions follow directly from the analysis of the linear relations which have been shown to exist between the partial dispersions of a series of optical glasses. They prove that a rise in the partial dispersion at any part of the spectrum is accompanied by a corresponding rise in partial dispersions over the entire visible spectrum."

G. E. BARTON (*C. A.*)

82. Automatic vial necking and bottoming machines. J. F. SPRINGER. *Glass Ind.*, **2**, 266–9(1921); 2 illus.—In the necking machines the necks are formed on pieces of tubing of a size for 2 vials one end at a time, the pieces being fed twice through the machine. The bottoming machine takes these tubes and seals off the center, forming the bottoms of the otherwise completed vials. J. B. PATCH (*C. A.*)

83. The electrical properties of glass. J. R. CLARKE. *Glass Ind.*, **2**, 221–3(1921).—Cf. *Ceram. Abs.*, **5**, 48(1922). J. B. PATCH (*C. A.*)

84. Steam gage glasses. J. F. SPRINGER. *Glass Ind.*, **2**, 240–3(1921); cf. *Ceram. Abs.*, **5**, 81(1922).—S. suggests greater tolerance in specifications for steam gage glasses with use of a proper washer, utilization of the waste tubing for lubricator tubes and the possibility of tooling the ends of the tube to meet specifications. J. B. PATCH (*C. A.*)

85. The effect of temperature upon the ultraviolet absorption of glasses. W. RIEDER. *Jahrb. Phil. Fak. II, Univ. Bern.*, **1**, 148–54(1921).—Twelve varieties of glass were studied at temps. up to 450° and in one case down to the temp. of liquid air and with wave lengths down to 2250 Å. All exhibited a transmission limit below which the transmission for all shorter wave lengths was zero. Increase of temp. in all cases raised this transmission limit toward the region of longer wave lengths. The data are recorded in the author's thesis ms. in 48 tables. E. W. W. (*C. A.*)

86. Free alkalinity in glass containers. A. W. BITTING. *Glass Ind.*, **2**, 235–7 (1921).—The results of 72 tests of typical bottles from various sources and of different shapes and sizes are tabulated. Flint, blue, green and amber glasses are included. The containers were filled to capacity with dil. H_2SO_4 and also distd. H_2O and allowed to stand from 1 to 48 hrs. The sol. alkali is expressed in mg. NaOH per l. The av. results range from 0.40 mg. NaOH per l. from a 250-cc. bottle to 26.64 and 33.92 mg. per l. obtained from a 5-cc. container. The effect of standing 2 weeks is just about to double the original reading and after that the increase proved to be very slow. The results of these tests indicate that American bottles have a low free alkalinity (at variance with what has been assumed to be true for machine-made ware). The quantity is so low as to be practically neglibible for any except very delicately balanced chem. products. J. B. PATCH (*C. A.*)

87. The manufacture of glass milk bottles. A. L. BROWN. *Glass Ind.*, **2**, 259–62 (1921).—A detailed story from raw materials and their handling through the melting and gathering of the glass to the sorting and packing of the finished product. A typical batch for milk bottles is: sand 2,000, soda ash 750, lime 250, niter 21, Mn 12–35 (av. 16), powdered blue 2 ounces. J. B. PATCH (*C. A.*)

88. Graded seal for joining pyrex to lead glass. W. C. TAYLOR AND AUSTIN BAILEY. *J. Ind. Eng. Chem.*, **13**, 1158(1921).—The seal consists of five glasses of Pb-free borosilicate compn., intermediate between pyrex and Pb-glass, which are all comparatively stable and can be worked repeatedly without devitrification. The range in softening point varies from 817° to 623° and the linear expansion coeff. from 0.0000032 to 0.0000089 per degree. GEO. W. STRATTON (*C. A.*)

PATENTS

89. **Method and apparatus for drawing sheet glass.** FERNAND E. DEULIN. U. S. 1,411,079, March 28, 1922. In a glass-drawing app. in which a sheet of glass is drawn vertically and then bent over a bending roll, a gas pipe with a longitudinal series of perforations, placed closely above and substantially parallel with the roll, so that a continuous series of flames from the perforations will play on the horizontal run of the sheet as it leaves the roll. C. M. S., JR.

90. **Glass-cutting mechanism.** HARRY S. DEPUTY. U. S. 1,407,736, Feb. 28, 1922. In a sheet glass scoring device, an axial support, a cutter mounted on the support, means for adjusting the cutter longitudinally of the support, and means for adjusting the support and cutter circumferentially, both means being operative from one end of the support. C. M. S., JR.

91. **Glass-cutting table.** HARRY M. BARBEAU. U. S. 1,410,153, March 21, 1922. In a glass-cutting table, a stationary guide measure, a slidable guide measure, a slidable stop coöperating with each guide measure, means for securing the slidable stops in fixed position, and means the position of which is limited by the slidable stops for detg. the line along which the glass is to be cut. C. M. S., JR.

92. **Frost and obscuring condensation preventative for glass surfaces and method of preparing the same.** PHILLIP SHERMAN. U. S. 1,410,839, March 28, 1922. A frost and obscuring-condensation preventive for glass surfaces, comprising a piece of fibrous material treated with a mixt. of mineral oil, vinegar, water and calcium chloride. C. M. S., JR.

93. **Method and apparatus for marvering glass.** DAVID E. GRAY AND FRANK E. BARDROF. U. S. 1,410,803, March 28, 1922. In a glass-working app., the combination with a main frame, of a blow-pipe carrying frame mounted for movement in the main frame, a marvering roller mounted for movement on the blow-pipe frame toward the blow-pipe and for a tilting movement in respect thereto, resilient means tending to move the roller, control mechanism on the main frame normally free from the roller, but adapted to be operatively engaged therewith by the movement of the blow-pipe frame, and when put into engagement therewith, adapted to first release the roller for movement toward the blow spindle and for then releasing it for its tilting movement; and means including the blow-pipe for rotating the marvering roller. C. M. S., JR.

94. **Heat-resisting iron-chromium-nickel alloy.** J. T. GLEKLER. U. S. 1,389,133, Aug. 30. An alloy adapted for glass molds or furnace parts is formed of Cr 15–40, Ni 1–15 and Fe to make a total of 100 parts, with small amts. of Si, Ti, Mn and C. (*C. A.*)

95. **Muffle oven for decorating or annealing glass or enamel ware.** C. E. FRAZIER. U. S. 1,389,583, Sept. 6. See *Ceram. Abs.*, **5**, 75(1922). (*C. A.*)

96. **Glass-covered steel rolls.** K. MATSUO. U. S. 1,394,684, Oct. 25. Rolls adapted for printing patterns on cloth are formed of steel pipe, the outer surface of which is smoothed and covered with a layer of milk glass which is rich in metallic constituents such as to give it about the same coeff. of expansion as steel. (*C. A.*)

97. **Glass containing mica or asbestos.** P. B. CROSSLEY. U. S. 1,394,973, Oct. 25. Mica or asbestos is dissolved in molten glass at a temp. below that at which the mica effloresces, to obtain an *elec. insulating material.* (*C. A.*)

98. **Glass composition.** E. E. FISHER. U. S. 1,394,296, Oct. 18. A glass adapted for the manuf. of baking or lab. dishes is formed of SiO_2 60–90%, B_2O_3 3–15%, oxides of Mg, Zn or Ba 3–15%, Al_2O_3 0.5–5% and oxides of Na, K, Li or Rb 6% or less. *C. A.*

99. **Daylight glass.** D. N. MACDONALD. U. S. 1,393,804, Oct. 18. Finely ground

Co-blue glass is thinly spread over and fused into the glass diffusing of enclosures for incandescent lamps to absorb excess red and yellow rays. (*C. A.*)

100. Glass working—glass—metal joints. H. Weiss. *Brit. Pat. Appl.* 174,925. *Ill. Off. Jour. Pats.*, **629,** March 29(1922).—An air tight joint for an anode is formed by metal coverings sprayed or deposited by electrolysis on the anode insulator, and comprises hollow rings having slits and containing a pliant material which melts when heated and passes into the slits so as to seal the joint; the metal covering extends over the hollow rings. Sketched. Wm. M. Clark

101. Aluminum, tungsten, and other oxides, alkali aluminates, tungstates, etc. J. D. Gat. *Brit. Pat.* 174,908. *Ill. Off. Jour.*, **622,** March 29(1922).—Describes equipment for preparing compounds of metal oxides with alkalis, such as aluminate or tungstate. Chlorine and sodium are liberated in the app. by electrolysis of fused NaCl, the sodium then reducing the clay, kaolin, bauxite, orthoclase, spodumene, etc., used. Wm. M. Clark

102. Method of and appliance for polishing glass and the like substances. William Taylor. England 1,409,888. The method of controlling the supply of liquid lubricant in the polishing of a surface by means of a polishing member. This member and the work are moved relatively to one another to effect the polishing, which method comprises utilizing the variation of frictional resistance between the surfaces of the work and polishing member to effect variation of the supply of lubricant. C. M. S., Jr.

103. Machine for angular grinding spectacle glasses. Otto Henker. Germany 1,409,546, March 14, 1922. In a machine intended for angular grinding spectacle-glasses of non-circular shape, a plane cam, a stop, a grindstone, and a shaft designed for holding the spectacle-glass, the cam coöperating with the stop and being disposed on the shaft, which is free to oscillate about an axis by which it is intersected perpendicularly and the axis of the grindstone crossed perpendicularly. The stop is rotatable about an axis, which is parallel to the axis of oscillation of the shaft and at variable distance from it. It lies in the plane detd. by the axis of oscillation and by the point which the angular edge of the spectacle glass has in common with the grinding surface. The cam is displaceable longitudinally on its shaft and is compelled by the stop to permanently contain in its plane the axis of rotation of the stop, on the shaft which is rotated. C. M. Saeger, Jr.

104. Apparatus for feeding molten glass. Karl E. Peiler. U. S. 1,405,936, Feb. 7, 1922. In an app. for sepg. molten glass into mold charges, the combination of a glass container having a submerged outlet, a reciprocating air pump arranged to create pressure and vacuum on alternate strokes, a conduit connecting the pump and the surface of the glass, a pressure relieving valve and a vacuum relieving valve in the conduit, a cam for opening each valve, means for relatively adjusting the cams, and means for independently adjusting the rate at which normal pressure is restored by each valve. C. M. Saeger, Jr.

105. Method of and apparatus for finishing blown-glass articles. David E. Gray. U. S. 1,409,847, March 14, 1922. In a device of the character described, the app. with a bulb-carrying mechanism has periods of rest at a plurality of stations; a burner is located at one of these stations and adapted to preheat a narrow zone around the neck of a bulb at such station; a burner located at a succeeding station and adapted to re-heat such pre-heated zone to cause the neck to elongate, and to puncture the elongated neck and sever the same. C. M. Saeger, Jr.

106. Glassware-ejecting mechanism. Edward H. Lorenz and Karl E. Peiler. U. S. 1,406,045, Feb. 7, 1922. A glass shaping machine having a plurality of traveling molds with bottom valves, ware-ejecting means including a reciprocatory plunger,

and mechanism adapted to force the plunger against the bottom valve of each mold in succession and thereby eject the contents of the molds while traveling. C. M. S., Jr.

107. Carrier for glass articles. Henry F. Clark. U. S. 1,405,757, Feb. 7, 1922. A carrier for glass shawls, comprising a movable frame adapted to be suspended from and travel upon an overhead track, said frame having supporting means for a plurality of the shawls, and spacers or separators movably mounted on the frame and adapted to sep. and space adjacent shawls, substantially as described. C. M. Saeger, Jr.

108. Ware steadier for glassworking machines. James W. Lynch. U. S. 1,406,400, Feb. 14, 1922. A device for preventing glass articles from being forced to either side of a mold having separable sections as the mold opens, the device including a movable stop having adjustable fingers adapted to embrace an article centrally positioned in the mold, and means for periodically moving the stop into a working position in which the fingers are about, but spaced from the upper portion of the article before the mold opens. C. M. Saeger, Jr.

109. Glass-plate manufacture. Albert A. Icenhour. U. S. 1,407,036, Feb. 21, 1922. In a process of making sheet-glass, drawing the sheet from a molten mass of glass in a container approx. the width of the sheet so that the edges of the sheet at the points of formation of the sheet travel down the interior of the wall of the container during the drawing operation, the container being tapered at opposite sides to cause the adhering edges of the plate to travel in vertical lines down the vertical channels formed by the tapering of the walls of the container. C. M. Saeger, Jr.

110. Grinding or polishing of glass and apparatus therefor. Frank Edwin Slocombe. England 1,404,553, Jan. 24, 1922. An app. for grinding or polishing plate glass, the combination with two opposed discs with grinding or polishing faces in parallel or nearly parallel planes and two horizontal shafts on which the discs are respectively mounted, the shaft being nearly parallel and out of line sufficiently to secure effective grinding or polishing at the centers of the discs, of means positively to rotate one disc, and sucker devices to secure the glass to be ground to a disc surface. C. M. S., Jr.

111. Glass cutter. Walter W. Ratcliff. U. S. 1,402,961, Jan. 10, 1922. A rotary glass cutter, comprising a base, a standard thereon having a laterally projecting portion terminating in a vertical head, a stem mounted for rotation and for vertical adjustment in the head, a cutting member carried by the lower end of the stem, a spring exerting a downward pressure on the stem, and means for raising the stem and cutting member against the influence of the spring. C. M. Saeger, Jr.

112. Mechanism for forming glassware. William J. Miller. U. S. 1,400,621, Dec. 20, 1921. In a machine for manufacturing articles of glass, the combination of forming means, a carrier intermittently revolving in a vertical plane beneath the forming means, and a plurality of molds pivotally mounted on the carrier and adapted to be presented in turn to the forming means, the pivotal axes of the molds being above their centers of gravity whereby the molds normally retain their upright position.. C. M. Saeger, Jr.

113. Sheet-glass-drawing mechanism. Robert P. Callard. U. S. 1,402,145, Jan. 3, 1922. A combination with a split demountable rim adapted to assume a collapsed state in its inoperative position, a double elbowed toggle having its outer ends connected to the end portions of the rim, one of the toggle links having a limited movement with respect to the toggle and disposed to overlap the rim. C. M. Saeger, Jr.

114. Glass-cutting machine. John A. Milliken. U. S. 1,402,457, Jan. 3, 1922. In a glass cutting mechanism of the character described comprising a chuck, a grinder, means for alternately moving the grinder into and out of engagement with an article to be operated upon, and a feeler member reciprocated to and from the article by corresponding movements of the grinder. C. M. Saeger, Jr.

115. Machine for the manufacture of glass articles. Robert Frederick Hall. England 1,408,939, March 7, 1922. A machine for blowing hollow glass articles including, (1) supporting frame, (2) a parison mold carried thereby, (3) means for actuating the parison mold which includes a member movable in a plurality of directions relatively to the supporting frame, (4) a knife adapted to be swung in an arc beneath the parison mold, (5) a vertically extending member on which the knife is carried, (6) means including a sleeve feathered on the vertically extending member and having a crank connected with horizontally reciprocable means for rotating the vertically extending member to effect the swinging movement of the knife beneath the parison mold, (7) bearings having a universal movement on the frame and on the relatively movable parison mold actuating member in which the vertically extending member is journaled, the vertically extending member also being slidable vertically in the bearing on the frame, whereby the knife is maintained in proper position irrespective of the relative movement of the parison mold actuating member. C. M. Saeger, Jr.

Enamels

116. Enameling cast-iron and steel materials. F. L. Prentiss. *Iron Age*, **109**, 13–16(1922).—This paper describes the methods and app. used in enameling cast-iron and steel tanks, etc., at the plant of the Elyria Enameled Products Co. The article is well illustrated. Donald E. Sharp (*C. A.*)

117. Enameled-products research laboratory. Emerson Poste. *Chem. Met. Eng.*, **25**, 974–7(1921).—The lab. and equipment are described and methods of control and research are briefly given. E. H. (*C. A.*)

Cement, Lime and Plaster

118. A compression test machine for cements. Guillery. *Rev. Mat. Constr. Trav. Pub.*, **147**, 240(1921).—(Read before the French and Belgian members of the International Association for Testing Materials.) This is an inexpensive machine for compression strengths of cement cubes of 5 cm. side and of concrete cylinders 10 cm. high and 10 cm. in diam. To a base plate is bolted a cylindrical support carrying a screw head at the top and worked by hand. A large piston with $^3/_4$ mm. play, slides inside the cylinder, a layer of rubber between them affording a tight fit. The compression chamber is placed in the base where the piston and its cylinder are suitably fitted into each other. The upper end of the piston is fitted with a removable copper support for the test piece. This support has a permanent large holder for catching the disintegrated fragments. The upper support for the cube has a slightly spherical face and is inserted into the screw head above. A compression pump, operated by hand and attached at one side, forces glycerine into the compression chamber and under the piston. A manometer indicates the pressure of the liquid. An adjustable safety valve limits the pressure, and a discharge valve relieves the pressure at the end of a test. The manometer carries three scales, the first giving the total pressure, the second giving resistance per sq. cm. on a cube of 5 cm. side, the third giving the resistance per sq. cm. for a concrete cylinder 10 cm. high and 10 cm. diam. With the piston in its lowest position, the screw is brought down on to the test piece, then the discharge valve is closed and the pump put into operation until the piece breaks. The resistance may then be read directly from the scale. A round plate 10 cm. in diam. constitutes the upper support fitted into the screw for crushing concrete cylinders. Louis Navias

119. Chemico-technical and mechanical testing of caustic magnesite. R. Poche. *Baumaterialien-Markt*, No. 36 and 38, **1921**. Reprint.—Since the value of burned magnesite as a building material can not be detd. from its chem. anal., the following tests

are necessary: I. *Sieve test.*—The residue remaining on 80 and 130 mesh sieves is detd., together with the wt. of a l. of the sieved material. No values are given. II. *Setting time.*—100 gm. magnesite are mixed for one min. with 40–52 cc. 20° Bé $MgCl_2$ soln. and poured out on a glass plate. The hardness is detd. with the Vicat needle app. The cake should be covered to prevent rapid drying. The setting time should be 2–5 hrs. III. *Expansion test.*—3 pts. by wt. of magnesite are mixed with 1 pt. of pine sawdust and moistened with 20° Bé $MgCl_2$ soln. The sawdust particles should be 50%–0–1 mm. and 50%–1–2 mm. in diam. A stick of the mixt. $^1/_2$–1 m. long is pressed out and allowed to set, being protected from drying. At least a month is required to attain const. length, although the first 10–14 days will give a good indication of the amt. of change. By the end of two weeks the linear expansion should not be $> 0.15\%$ or the contraction $> 0.25\%$. The air around the test piece must have a rel. humidity of $60 \pm 6\%$. IV. *Tensile strength.*—The test piece is made of the same material used in the expansion test. After 3 days the tensile strength should not be < 8 or > 25 kg./cm.^{2} after 7 days, not < 20, after 56 days not < 40 kg./cm.^{2}

E. N. Bunting

120. Blast-furnace cement. H. Burchartz. *Mitt. Materialprüfungsamt*, **38**, 163–182(1920).—The investigation was made to det. whether blast-furnace cement might be safely used in construction work in which the German government was interested. Six blast-furnace cements were analyzed and tested. The best and the poorest of these were compared with 2 portland and 2 iron portland cements. The tests included mortars and reinforced concrete; they lasted from 1914 to 1919. The blast-furnace slag mortars and concrete were as strong as those from portland cement. The blast-furnace cements contained 60–75% of slag. This was detd. by dividing the total sulfide S by that found in the part of the cement remaining on a 100-mesh sieve and of lower sp. gr. than 2.98. The sulfide percentages in the slags varied from 1.49 to 3.02 and were 2.42 in the weakest and 2.71 in the slag in the strongest cement. MgO in the weakest cement was 1.98% and in the strongest 2.81%. SiO_2, 27.7% and 26%, resp., Al_2O_3 and Fe_2O_3, 9.98% and 12.60%. CaO, 53.22% and 51.88%. SO_3, 1.14% in both. Undetd., 1.80 and 1.33%. The crushing strength of mixts. by wt. of 1 part cement and 3 of sand (normal) averaged for blast-furnace cement mix, 5401 lb. per in.^{2}; iron portland cement mix, 5473 lb.; portland cement mix, 4995 lb. per in.^{2} After 2.5 yrs., 1:4 mixts. by wt. showed, resp., in reinforced concrete, 7008, 7037 and 7867 lb. per in.^{2} The larger part of the admixture was a graduated one of sand and gravel. Mixts. of 1 part by wt. of cement and 5 parts of raw sand showed a crushing strength of 6000 lb. after air and water exposure for 5 yrs. and 4700 lb. per in.^{2} if in water all the time. There was no recession in strength in any of the blast-furnace cement mixt. The German government authorized the use of blast-furnace cement on government work. Cf. *Ceram. Abs.*, **5**, 50(1922).

J. O. H. (*C. A.*)

121. Plastic calcined magnesite and oxychloride cements. M. Y. Seaton. *Chem. Met. Eng.*, **25**, 233–6(1921).—The history, chem. compn. and the usual source of the raw materials of oxychloride cements are given. The following physical tests are discussed: strength, vol. change, setting, time, resistance to water and the influence of the character of the aggregate. Suggested specifications include: fineness—97% through a 100-mesh sieve, 75% through a 200-mesh sieve; setting time (plastic oxychloride mortar)—initial set not less than 1 hr., final set not more than 8 hrs.; modulus of rupture (on bars $^1/_2$ in. thick 2 in. wide and 24 in. long)—not less than 550 lb. per sq. in. at 1 day and 100 lb. per sq. in. at 7 days; expansion or contraction not less than 0.3% within 24 hrs.; wet strength should be at least 30% of dry strength. See *Ceram. Abs.*, **5**, 88(1922).

J. C. Witt (*C. A.*)

122. The successful recovery of potash as a by-product from cement kilns. C.

KRARUP. *Chem. Met. Eng.*, **25**, 316–20(1921).—The recovery of potash at the plant of the Santa Cruz Portland Cement Co. is described. Several new features have been introduced. J. C. WITT (*C. A.*)

123. Judging the quality of portland cement. R. J. COLONY. *Trans. Am. Inst. Mining Eng.*, **1921**, No. 1088, 3 pp.; See *Ceram. Abs.*, **5**, 51(1921).—A reply to discussion. C. N. WILEY (*C. A.*)

124. Action of lime in magnesium oxychloride cements. M. Y. SEATON, C. R. HILL AND L. C. STEWART. *Chem. Met. Eng.*, **25**, 270–4(1921).—The influence of active lime (CaO or $Ca(OH)_2$) on Mg oxychloride cements is discussed. Methods of detg. the amt. of active lime present on agitation with H_2O and detn. of alkalinity with phenolphthalein indicator; agitation with 5% NaCl soln. and detn. of alkalinity with methyl orange indicator; agitation with $MgCl_2$ soln. and detn. of $CaCl_2$ in the soln. Comparable results were not obtained by the use of the 3 methods. A relation between active lime content of calcined magnesites and physical properties of the oxychloride cement produced from them is brought out. This relationship is apparent only when av. results from many samples are considered. Other factors may completely obscure the relation in a test on a single sample. Active lime content is accordingly not a definite indication of poor quality in a magnesite, although a magnesite contg. active lime in large amt. should be regarded with suspicion. Physical tests of oxychloride cements must still be regarded as the only safe criterion of the quality of magnesites used in the oxychloride industries. J. C. WITT (*C. A.*)

125. An outline of the uses of lime. M. E. HOLMES. *Chem. Met. Eng.*, **26**, 294–300(1922). E. J. C.

PATENTS

126. Magnesium oxychloride cement. J. L. TUFTS. U. S. 1,386,914, Aug. 9. A dry cement material is produced by agitating calcined magnesite in a closed vessel while introducing into the material sufficient HCl gas and H_2O vapor to produce a product in the proportions of 5 MgO, 1 $MgCl_2$, 5 H_2O. (*C. A.*)

127. Plaster composition. C. NOLL. U. S. 1,393,814, Oct. 18. Plaster for use on walls or ceilings is formed of $Ca(OH)_2$ 20, clay 15, sand 40 and a porous material such as blast-furnace slag 25 parts. (*C. A.*)

128. Increasing plasticity of calcined gypsum. W. E. EMLEY. U. S. 1,392,574, Oct. 4. Calcined gypsum is ground in a ball mill to eliminate the H_2O content during the grinding operation but the H_2O is prevented from escaping and is permitted to be reabsorbed before the completion of the grinding in order to obtain a finely ground product of good plasticity. (*C. A.*)

129. Liquid ceramic pastes. E. WEBER. U. S. 1,394,241, Oct. 18. Ceramic pastes which are difficultly liquefied with alkali are treated with saponin to facilitate liquefaction in order to improve the pouring and molding properties of the material. Quillaja or senegin also may be used for the same effect. (*C. A.*)

130. Cement. WALTER T. GODDARD. Canada 1,409,091, March 7, 1922. A cement compn. containing an inert non-friable element initially coated with an elastic substance. C. M. SAEGER, JR.

131. Multiple brick mold. FRANK J. KINZINGER. Canada 1,406,460, Feb. 14, 1922. A multiple mold for concrete bricks and the like comprising end plates, a series of interposed longitudinal mold forming members each including a verticle base plate, and a series of right angle plates secured in contiguous alignment on the base plate, and means for securing the end plates and the mold forming members together. C. M. S., JR.

132. Method and machine for forming impressions in plastic articles. JOHN LAPP. U. S. 1,407,550. Feb. 21, 1922. A method of forming impressions in plastic articles which consists in gyrating a forming tool about the axis of the surface to be im-

pressed but without rotation about its own axis and gradually varying the radius of the tool's gyration. C. M. Saeger, Jr.

133. Concrete-tie-making machine. John Nelson. U. S. 1,400,969, Dec. 20, 1921. A tie-making machine comprising cement feeding app.; movable mold jaws adapted to receive the cement from the feeding app.; automatic operating means for the jaws adapted for engaging the cement during operation, and means adapted for positioning a reinforcing member between the jaws for embedding in the finished tie. C. M. Saeger, Jr.

134. Method of producing a cold glaze for building materials, in particular cement. Karl Friedrich. Germany 1,402,412. Jan. 3, 1922. A method of producing a cold glaze consisting in mixing a finely sifted, sandfree building material with an emulsion of water containing bituminous substances free of volatile oils and oxidized in the presence of alkalis. C. M. Saeger, Jr.

135. Means for use in the manufacture of concrete roofing tile. William Thomas Cowperthwaite. New Zealand 1,403,940, Jan. 17, 1922. The combination of a pallet adapted to support in a horizontal position a plate of plastic material and having a flange forming portion having an aperture therein; a pin adapted to project through the aperture during the molding operation and to be withdrawn after the molding operation has been completed; a bearing frame beneath the pallet; a slide mounted thereon; a rod mounted on the side slide to which the pin is fixed; a spring controlling the rod and keeping it in position to withdraw the pin from the aperture; a main shaft; a lever arm pivoted beneath the pallet and having its end engaging the back end of the rod; and means whereby the lever arm may be turned to push the rod outwardly, the means being controlled by the operation of the main shaft. C. M. Saeger, Jr.

136. Heat insulating and resisting material. Edgar T. Holmberg. U. S. 1,404,438, Jan. 24, 1922. A heat insulating and resisting material made by moistening a mixture of about 30% magnesia and 70% of an infusorial siliceous earth with a saturated solution of magnesium chloride and compressing such moistened mixture in a mold. C. M. Saeger, Jr.

137. Building-block. Charles C. Worthington. U. S. 1,400,709, Dec. 20, 1921. As a new article of manufacture, a building block comprising a rectangular body of stonelike material cast with horizontal rectangular cavities formed by a plurality of vertical cross walls, which are disposed perpendicular to the face of the block and also by vertical longitudinal back walls forming the backs of the cavities, one of the vertical walls being a partition wall between adjacent cavities, each of the walls being of uniform thickness and a fictile nailing material cast in position in each of the cavities to be exposed on the surface of the wall constructed of such blocks. C. M. Saeger, Jr.

138. Cement-block machine. Clement Zophy. U. S. 1,408,558, March 7, 1922. A machine of the class described comprising a supporting structure including vertical standards having their intermediate portions vertically recessed, a mold box mounted on the supporting structure, a removable pallet closing the bottom of the mold box, a slide block slidably mounted in the recess of each standard, a transverse channel beam carried by each slide block, a supporting member carried by each connected together slide block and channel beam, shafts journaled adjacent the ends of the channel beams, lifting arms carried by the shafts, roller means carried by the outer ends of the lifting arms and tracking in the channels of the beams, and means for simultaneously rotating the shafts in opposite directions to raise the pallet above the mold to permit the stripping of a block which has been formed in the mold box. C. M. Saeger, Jr.

CERAMIC ABSTRACTS

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General and Miscellaneous

1. Dry purification of kaolins. ANTI DAHLE. *Sprechsaal*, **54**, 393–396(1922).—The sepn. of graphite by air currents has been highly perfected. This sepn. is possible because of the sp. gr. of the different ingredients. Thus graphite has a sp. gr. of 1.9–2.3, quartz 2.5–2.8, granite 2.3–3.00, mica 2.6–3.2 and clay 1.8–2.6. Similarly the sp. gr. of kaolin is 2.2–2.6, quartz 2.5–2.8, feldspar 2.5–2.6 and mica 2.6–3.2. Two methods are used and are known as (1) air or wind separators and (2) centrifugal separators. In the first type powdered kaolin is drawn thru a chamber by means of an air current and the heavy and coarser material is deposited. By this method the crude kaolin may be separated into the following portions (1) kaolin powder, (2) coarse kaolin, (3) quartz particles, (4) feldspar particles, (5) mica particles, (6) some quartz particles, (7) some feldspar particles, and (8) crude kaolin. By means of the centrifugal process the kaolin may be separated into the following portions and in combination with the air sepn. may be still further refined. Product (1) after screening from mica and org. matter a pure kaolin is obtained. Product (3) consists of feldpar and quartz and is discarded. Product (4) is crushed a second time in rolls and again run through the separator. Product (2) is passed through the rolls and then is passed to the wind separator which separates this portion into four portions, one of which is pure kaolin. The opern. has to be adjusted for each clay. H. G. SCHURECHT

2. Monorail conveyors on clay plants. ANON. *Brick and Clay Record*, **60**, 613–615 (1922).—Overhead monorail conveyors system is described for handling both the raw material and ware in the various stages of its manuf. H. G. SCHURECHT

3. Modern installation for crushing and screening basalt. E. C. BLANC. *Rev. Mat. Constr. Trav. Pub.*, **149**, 31–34(1922).—Basalt from a certain quarry in the middle of France is crushed and screened and used for railroad and road making. A plan and photographs of the plant are given with descriptions of mech. crushers and sorters. LOUIS NAVIAS

4. Some practical considerations with handling plant. ALWYNE MEADE. *Chem. Age* (London), **6**, 228–9(1922).—Need for considering depreciations in selection of mech. handling devices for chem. plants is pointed out. Construction of storage hoppers for hard and abrasive materials is discussed. A. E. MARSHALL (*C. A.*)

5. The evolution of chemical terminology. I. Coagulation. JAMES F. COUCH. *Am. J. Pharm.*, **94**, 92–7(1922).—A review and discussion. W. G. GAESSLER (*C. A.*)

6. Electrical precipitation of cement mill dust. G. A. WITTE. *Gen. Elec. Rev.*, **25**, 125–7(1922).—Several Cottrell elec. pptn. installations are briefly described, and the flexibility in construction is noted for both the plate and pipe types. Power may be

taken from the factory line when a synchronous motor is substituted for the motor-generator set. Multiple pipe type precipitators are energized from a 75,000-v. circuit and the plate type treaters from a 50,000-v. circuit. About 5% of the total raw material fed into the kiln is recovered as collected dust. Its utility depends upon its water-sol. K value and dets. its use for CaO-K_2O fertilizer, mixed fertilizers, or leaching for production of high-grade potash salts. Dust of low potash content can be returned at regular intervals to the kiln. Domestic and foreign Cottrell installations are listed.

W. H. B. (*C. A.*)

7. Constitution and heat of combustion. F. O. H. Binder. *Chem.-Ztg.*, **45**, 1114–6(1921); cf. *C. A.*, **16**, 10.—The heat of combustion of an org. compd. in cal. per mole may be computed from the formula: $55{,}560\,x + 23{,}570\,y + 34{,}170\,z$, where x = the no. of C-to-H bonds, y = twice the no. of single C-to-C unions, and z = twice the no. of extra C-to-C bonds. A C-to-N bond equals 35,016 cal. The article gives the results of calcns., compared to observations, for a no. of compds. The agreement is only moderately close. The ketone formula for *quinone* is less likely than the peroxide formula.

Ernest W Thiele (*C. A.*)

8. From laboratory experiment to factory apparatus. H. Blücher. *Chem.-Ztg.*, **45**, 1133–5, 1163–5, 1182–6(1921).—This detailed discussion, contg. nothing essentially new, is written primarily for the inexperienced industrial chemist, and deals with the application of research methods to factory scale. The subjects discussed are: (*a*) quantity and nature of raw materials; (*b*) the time factor; (*c*) heating; (*d*) cooling; (*e*) high pressure technic; (*f*) vacuum; (*g*) grinding; (*h*) mixing and stirring; (*i*) settling and leaching; (*j*) filtration; (*k*) centrifuging; (*l*) distn.; (*m*) drying; (*n*) miscellaneous; (*o*) results: patents, secret processes, and marketing of product.

Theo. F. Buehrer (*C. A.*)

9. The international chemical index and the reproduction of documents. J. H. Frydlender. *Rev. prod. chim.*, **25**, 73–8(1922).—A general discussion of the problem of searching the literature on a given subject and of obtaining original articles or documents which may need to be consulted.

A. P.-C. (*C. A.*)

10. Simplified stack calculations. Otto Hoffmann. *Feuerungstechnik*, **10**, 53–6, 65–8, 79–82(1922).—Review of previous formulas and development of new formulas for computing stack dimensions from the conditions of the installation.

E. W. T. (*C. A.*)

11. The thermal expansion of chromium and of nickel-chromium alloys over an extended range of temperatures. P. Chevenard. *Compt. rend.*, **174**, 109–12(1922).—The expansion behavior of Cr over a considerable range of temp. being hitherto unrecorded, C. undertook this detn., and in addition, to study the effect of varying amts. of Cr upon the thermal expansion of Ni-Cr alloys. The expts. were performed with the differential app. previously described, in which the specimen bar is opposed by a standard bar of "Baros" (alloy of Ni-Cr contg. 10% Cr) whose rate of expansion has been directly detd. with frequent checks over the range from 0° to 1000°. Between 0° and 100° the expansion of Cr is exactly reversible, and the metal appears to be dispossessed of all thermal singularity. The true coeff., which at 0° = 6.8×10^{-6}, increases rapidly with rise in temp., the curve which traces this variation presenting a gentle concavity with increase in temp. The magnetic transformation of Ni is accompanied by rapid diminution of the true expansion coeff. and the temp. at which this change was found to occur coincides appreciably with the temp. of the Curie point detd. by thermomagnetic methods. The addition of Cr, itself having a much smaller expansion coeff. than Ni, affects little the coeff. of expansion of the latter metal at ordinary temps., but tends to increase at higher temps. This considerable disparity from the behavior of mixts. is

probably due to the presence of the compd. Ni_2Cr_3, whose existence has been established by Voss and confirmed by the author. J. T. R. Andrews (*C. A.*)

12. Calite—A new heat-resisting alloy. G. R. Brophy. *Trans. Am. Soc. Steel Treating*, **2**, 384–6(1922).—Calite is an easily castable, but difficultly forgeable, alloy of Al, Ni, and Fe, which will not oxidize at temps. up to 1300°. Its m.p. is 1500°, the elec. resistivity is 112 ohms/cm.^{3}, the temp. coeff. is 0.00044, and the heat resistivity is 3.25 times that of Ni. The alloy is highly resistant to atm. corrosion, the action of acids (except HCl and H_2SO_4) molten NaCN, $BaCl_2$, S, or NaCl. It retained a perfect polish after 100 hrs. in a salt spray at 100°F. Fluxes such as cryolites, borates, and silicates attack it rapidly. The details of casting are given. W. A. Mudge (*C. A.*)

13. First large plant using pulverized coal exclusively. Anon. *Elec. World*, **79**, 721–4(1922); illus.—A detailed account with plan of the plant shown, of 40,000 kva. central station at Milwaukee. C. G. F. (*C. A.*)

14. Characterization of clay. N. M. Comber *J. Soc. Chem. Ind.*, **41**, 77–80T (1922).—C. concludes "The constitutional characteristic of clay which distinguishes it from other systems of siliceous mineral particles is that in clay the properties of the emulsoid and surface outweigh those of the suspensoid 'core' whereas in silt, etc., the properties of the core of the particles are not dominated by the relatively smaller amt. of emulsoid surface." Wm. M. Clark (*C. A.*)

15. Electroösmosis. P. H. Prausnitz. *Z. Elektrochem.*, **28**, 27–36(1922).—A survey of expts. indicating how electroösmosis and related processes may be applied technically. The importance of further development of the electrochemistry of colloids is discussed. H. Jermain Creighton (*C. A.*)

16. Progress in metric standardization. E. C. Bingham. *J. Ind. Eng. Chem.*, **14**, 332–4(1922). E. J. C. (*C. A.*)

17. The importance of low handling costs. Herbert Blyth. *Chem. Age* (London), **6**, 226–8(1922).—A description of the present lack of mech. handling devices in English chem. works. Pneumatic methods are given for (1) unloading from slips; (2) unloading from railroad cars; (3) conveying to storage or point of use in plant. A. E. M. (*C. A.*)

18. Preparing and distributing powdered coal. E. C. Greisen. *Iron Age*, **109**, 326–9(1922). E. J. C. (*C. A.*)

19. Note on the production and testing of zirconia. W. R. Schoeller. *J. Soc. Chem. Ind.*, **40**, 127–8T(1921).—Processes for extg. zirconia from Brazilian ore by pptn. as basic sulfate (*C. A.*, **16**, 992) aim to eliminate Fe without regard to removal of Ti. Analyses of Brazilian ore by the method of Powell and Schoeller (*C. A.*, **14**, 708) show TiO_2 in quantities varying from 0.6 to 1.2%. The process based on the prepn. of crystd. $ZrOCl_2$ yields c.p. ZrO_2, but is expensive on account of the low recovery. S. modifies this process by reworking the mother liquors and wash waters obtained from the crystn. of c.p. $ZrOCl_2$ so as to obtain the remainder of the ZrO_2 in a form pure enough for industrial purposes. Analyses of samples of British zirconia show as impurities SiO_2, TiO_2, Al_2O_3, Fe_2O_3, As_2O_5, SO_3. The presence of As is highly objectionable; for its detn. 2 g. of ZrO_2 are fused with 15–20 g. Na_2CO_3 in a Pt crucible; the melt is leached with hot H_2O, the soln. filtered, acidified with HCl, and satd. with H_2S. The As_2S_3 is filtered off, evapd. with H_2SO_4 until fumes are evolved, the liquid is made alk. with $NaHCO_3$, and titrated with I soln. T. S. Carswell (*C. A.*)

20. The measurement of absolute viscosity. F. M. Lidstone. *Phil. Mag.*, **43**, 354–7(1922).—In the measurement of viscosity by the rate of flow method under varying head it is not accurate to use the mean head. If the difference between initial and final head is great the error is large. Formulas and tables are given for the accurate calcn. S. C. L. (*C. A.*)

PATENTS

21. Drying rack for pottery manufacture. Charles L. Sebring. U. S. 1,410,275, March 21, 1922. In a drying rack and conveyor of the character described, a drying chamber, a compartment formed near one end of the drying chamber and provided with openings on opposite sides in the drying chamber, the adjacent end of the drying chamber being provided with an opening and a conveyor movable through a circuitous course within the drying chamber and around the compartment, the conveyor moving adjacent to all of the openings. C. M. S., Jr.

22. Furnace for brick and tile kilns. Halver R. Straight. U. S. 1,411,534, April 4, 1922. A fur. for brick and tile kilns comprising a downwardly and outwardly inclined tube through the wall of the kiln, and having means at the lower and outer end for feeding combustible gases, and at its upper and inner end means for mixing the gases as they enter the kiln. C. M. S., Jr.

23. Kiln. Jerome B. Riffle and Louis H. Hartman. U. S. 1,411,871, April 4, 1922. In a kiln as characterized, a flue disposed centrally of the kiln, fur. disposed at opposite sides of the kiln and having heat conducting passages connecting the centrally disposed flue, a heat reflector disposed within the lower portion of the centrally disposed flue and interposed between the opposed ends of the heat conducting passages, exit flues extending radially of the kiln beneath the floor thereof and in communication with the interior of the kiln through openings formed in the floor of the latter, the exit flues having laterally extending branches disposed inwardly of and parallel to the vertical wall of the kiln and in communication with the interior of the latter through openings formed in the floor thereof, stacks spaced around the top face of the vertical wall of the kiln and having the flues thereof extending downwardly within the latter, the lower ends of the flues in the vertical wall of the kiln being arranged in communication with the outer ends of the radially extending exit flues, and dampers operable in the flues of the stacks for controlling the distribution of the heated air in its passage through the kiln from the centrally disposed flue. C. M. S., Jr.

24. Foundry sand. A. Poulson and C. J. Rourke. Brit. 173,687, Dec. 11, 1920. $Al_2(SO_4)_3$, 37 1/2–45%, 37 1/2–45% of china clay and 10–25% of ground pitch are reduced to powder and thoroughly mixed and incorporated with the sand, water being added to give the necessary dampness. To renovate an ordinary sand which has been burnt completely, about 1 cwt. per ton of sand is added. (*C. A.*)

Apparatus and Instruments

25. Difficulties encountered in the installation of a pyrometer system. R. S. Whipple. *Ceramique*, **25**, 65–70(1922).—A translation of the article which appeared in *Trans. Ceram. Soc.* (1921). H. G. Schurecht

26. Routine gas analysis apparatus. R. V. Wheeler. *Gas. J.*, **157**, 702–3(1922); 4 figs.—A simplified adaptation of the Hempel app., which in some respects resembles the Orsat app., is described. The usual 2 sources of error (one which occurs through admittance of a bubble of air when one absorption vessel is detached from the other and substitution made, and the other due to the absence of facilities for washing the gases after treatment with the various absorbents) are eliminated and the app. is made handier in use, by connecting all the absorption vessels and the explosion vessel to the measuring buret by a system of 3-way taps, and by provision of washing facilities. The app. is adapted for the analysis of coal gas and coke-oven gas and gives results sufficiently accurate for routine work. The methods of absorption and explosion are explained and the manipulation is described. Each analysis of coal gas requires about 1/2 hr. Four sep. analyses can be carried on at once in different stages. J. L. Wiley (*C. A.*)

27. A new X-ray diffraction apparatus. Wheeler P. Davey. *J. Optical Soc. Am.*, 5, 479–93(1921).—An app. is described by which the characteristic X-ray diffraction patterns of 15 powdered crystals may be taken at once. Each pattern is recorded on a strip of photographic film $1^7/_8 \times 16$ in. held in a cassette on the arc of a circle of 8 in. radius, at the center of which is placed the glass tube contg. the specimen. The cassettes are radially disposed on a circular horizontal table at a fixed distance from a vertical H_2O-cooled MO-target Coolidge tube. The tube is excited by a specially designed transformer without rectifiers, placed under the table, thus constituting a complete compact self-contained app. The slit system is of special design for photographic analysis and contains one ZrO_2 filter, while the other filter is built into the cassettes. The time required to obtain satisfactory results varies from 5 to 12 hrs. for substances like NaCl to from 48 to 70 hrs. for CuCl, CsI, etc. The diffraction pattern may be interpreted directly in terms of interplaner distances in the crystal by means of a metal scale calibrated in Å. Graphs are included by means of which the crystal structure may be interpreted directly from the interplaner distances for the cubic, tetragonal and hexagonal systems.
G. L. Clark (*C. A.*)

28. High-speed high-vacua mercury vapor pumps. C. T. Knipp. *Science*, 55, 183–4(1922).—Two high-speed pumps are described. Sketches are given showing the simplicity of construction. The glass used is Pyrex. D. E. Sharp (*C. A.*)

29. Titration apparatus with automatically fixed zero point. Adolf Bräuer. *Chem.-Ztg.*, 46, 117(1922).—The buret has cocks below and above the graduated section, the zero point being at the upper (3-way) cock, above which is a small overflow reservoir. Below the lower cock the buret is drawn to a stem which reaches nearly to the bottom of the stock bottle; the app. is filled by blowing into the bottle, the soln. being withdrawn through a side-tube above the lower cock. J. H. Moore (*C. A.*)

30. The use of the optical pyrometer in practice. Karl Daeves. *Stahl u. Eisen*, 42, 121(1922).—Optical pyrometers suitable for works use are either of the Wanner or Holborn-Kurlbaum type. The latter, in which the intensity of one wave length emitted by the body to be measured is compared with a lamp filament, is the best. In the Wanner pyrometer the light is polarized and its intensity measured by the rotation of the analyzing nicol necessary to make it comparable to a standard illumination. For measurements in a muffle (black body condition) the temp. may be detd. within ± 10° with a pyrometer of the H.-K. type. If measurements are made under other conditions they must be corrected according to the formula $\log e = (C \log E/\lambda)\,(1/T_a - 1/Sa)$, where e is the emissivity of the body to be measured, $C = 14{,}500$, $\log E = 0.4343$, S_a = observed temperature, T_a = actual temp., λ the wave length of the light used in μ. Burgess' values for emissivity are: liquid iron 0.4, liquid iron oxide 0.5, refractories 0.6, liquid slag 0.65. R. S. Dean (*C. A.*)

31. Draft device for laboratories. M. Fischler. *Z. angew. Chem.*, 35, 43(1922); 1 cut.—A bent pipe or tile is inserted in the stove hole of a chimney. A gas flame in the upper end increases the draft and the lower end is placed over the mouth of the flask to catch the fumes. J. H. Moore (*C. A.*)

32. Flue gas testers. F. O. H. Binder. *Chem.-Ztg.*, 46, 149–51(1922).—Descriptions with cuts, of (1) Schumacher's "Oekonometer," an app. in which the gas is weighed and the change in sp. gr. due to varying amts. of CO_2 is recorded on a chart as % CO_2; (2) Maihack's "Duplex-Mono," by which both the burned and unburned constituents of the gas are detd. alternately, the 1st by direct absorption and the 2nd by absorption after burning in a CuO furnace heated by electricity; (3) the "Union gas tester," which depends on the relative friction resistance of the gas and air when passed through a narrow tube. J. H. Moore (*C. A.*)

33. 1920 Report of Committee on Pyrometer. W. E. Forsythe. *J. Optical Soc.*

Am., **5**, 494–512(1921).—F. redefines brightness temp., color temp., and some less used varieties of temp., gives simple working directions covering the whole subject of optical pyrometry, including construction and the avoidance of certain errors, and adds a brief record of the year's literature on the subject. W. P. White (*C. A.*)

34. New graphic B.t.u. calculator. M. C. K. Jones. *Gas Age-Record*, **49**, 392–4 (1922).—A copyrighted diagram is shown by means of which lengthy calcns. are avoided in connection with lab. calorimeter tests. It may also be used to find correction factors for correcting gas vols. in routine lab. practice, in such tests as the estn. of H_2S, $C_{10}H_8$, CN, etc. It is based upon the general heating value formula. Observed B.t.u. = $[WT/0.2(B - A_t)(460 + 60)] \div [(30 - 0.517)(460 + t)]$, where W = wt. of H_2O heated, T = temp. rise of H_2O, B = barometer in in. Hg, A_t = tension of aq. vapor corresponding to temp. of gas, t = temp. of gas. J. L. Wiley (*C. A.*)

35. Brady B. t. u. indicator tests. O. L. Kowalke. *Gas Age-Record*, **49**, 405–6 (1922); cf. *C. A.*, **14**, 338, 3781.—Tests were made to det. how accurately the heating value of gas could be measured and how to operate the instrument most effectively. Results were checked against a Sargent continuous flow gas calorimeter. It was found that the Brady app. has the tendency to read too low when the gas becomes richer and too high when the heating value drops from the point when the instrument was standardized. Diluents such as CO_2 and N_2 and combustibles like H_2 and CO have a marked effect on the indications of the instrument. It is not an instrument of precision but will give reasonable approximations when calibrated on a gas similar in heating value and compn. to that which is to be tested. J. L. Wiley (*C. A.*)

36. Brick-making in remote mining districts. H. C. Robson. *Mining & Sci. Press*, **124**, 187–91(1922).—Brick making in Siberia is described.

R. R. Danielson (*C. A.*)

37. Modern apparatus for the control of combustion and heating. Lucien Mauge. *Bull. soc. encour.*, **133**, 1237–1321(1921).—A more extended discussion of matter treated by Berthelot, *Ceram. Abs.*, **1**, 34(1922). Donald W. MacArdle (*C. A.*)

38. Color classification of blast furnace slags. W. G. Imhoff. *Blast Furnace Steel Plant*, **9**, 433–4(1921); cf. *C. A.*, **11**, 1622, 2877.—The purpose of this paper is (1) to furnish scientific data on "molten magmas" to the geologist and (2) to give the blast-furnace man a complete table of "color classification of blast furnace slags." It is professed to be the first attempt to classify slags scientifically. The analogy between slags and ordinary molten magmas and basaltic lava is emphasized. It is maintained that temp. and slag compn. are functions of one another. C. C. Davis (*C. A.*)

PATENT

39. Refractory cover for electric furnaces. Monroe S. Clawson. U. S. 1,410, 654, March 28, 1922. In combination with an elec. fur. including a crucible supported between heads, a carriage movable toward and away from the crucible, and a cover for the crucible formed of refractory material and supported by the carriage.

C. M. S., Jr.

Chemistry, Physics and Geology

40. Regarding the accuracy of quantitative chemical analyses. E. Selch and R. Garstenauer. *Sprechsaal*, **54**, 432–43(1921).—The analyses were obtained of the same sand as in table which follows on page 202. Sample I was obtained from the mines while sample II was obtained from a customer. The presence of impurities in II is probably due to storage. Chem. analyses are seldom made which are more accurate than 0.01, and to state the chem. analyses in the third place is misleading. Errors due to impurities in the reagents, to incomplete chem. reactions and to

	I	II
SiO_2	99.85	98.60
Al_2O_3	0.05	0.331
ZrO	....	
Fe_2O_3	0.011	0.010
MgO	....	0.190
CaO	0.01	0.158
CuO	....	0.093
SO_3	....	0.082
S	....	0.018
Na_2O +	0.02	0.220
K_2O	....	.....
Loss on ignit.	0.10	.....
	100.041	99.70

inaccurate weighing would prevent an accuracy of more than one in the second place with the exception of analyses made by calorimetric methods.

H. G. SCHURECHT

41. Physical chemistry of the oxides of lead. III. Hydrated lead monoxide. SAML. GLASSTONE. *J. Chem. Soc.*, **121**, 58–66(1922); cf. *Ceram. Abs.*, **1**, 104(1922).—Expts. of previous investigators were repeated; none of the methods described yield substances having definitely the reported compns., 3 $PbO.H_2O$ or 2 $PbO.H_2O$. The products are either pure 5 PbO.2 H_2O or 8 PbO.3 H_2O or solid solns. of two or more simple hydrated oxides. It was not possible to decide between these alternatives but on the whole the data favor the former. The compn. of the ppt. from a Pb salt soln. by alkali depends on temp. and concn. of the precipitant, probably because of variation in the amt. of adsorbed water. Every prepn. examd. lost water on heating until decompn. set in at a point which was almost identical in every case (3.08–3.13% water). The dissociation const. of $H.HPbO_2$ produced by dissolving hydrated PbO in water was found by methods previously described to be 1.35×10^{-12} at 25°. The hydrated oxides have no appreciable vapor pressure; this and other properties are best explained by the assumption that they are salts of $H.HPbO_2$, *e. g.*, $Pb(HPbO_2)_2$. Attempts to prep. *Ag plumbite* gave a product roughly corresponding to $(AgHPbO_2)_2Ag_2O$. A. R. M. (*C. A.*)

42. A simple method for the determination of melting points and critical temperatures. W. HEIKE. *Z. anorg. allgem. Chem.*, **118**, 254(1921).—Note pointing out accuracy of 814.5– as m.p. of *arsenic*. G. L. CLARK (*C. A.*)

43. Zinc borate. T. C. N. BROEKSMIT. *Pharm. Weekblad*, **59**, 265–8(1922).—Zn is pptd. quant. in a gelatinous form by the mol. equiv. of borax soln. A. W. DOX (*C. A.*)

44. Economic mineralogy. J. A. HOWE. *J. Soc. Chem. Ind.*, **41**, 21–3R(1922).—An instructive address, illustrated by many examples which occurred during the war. Among important problems yet to be solved are: more efficient utilization of fuels, improvement in ore extn., and finding of uses for many minerals containing common or rare elements. L. W. RIGGS (*C. A.*)

45. Analysis of basic slag (citric-soluble P_2O_5). ANON. *J. S. African Chem. Inst.*, **5**, 16–19(1922).—Results obtained by different analysts for the citric-sol. P_2O_5-content of a prepd. sample of basic slag are tabulated for comparison. The official method and other methods were used. The official method consisting in extg. the sample with a 2% soln. of citric acid, pptg. of the P with molybdate, and subsequently with magnesia mixt. S. G. SIMPSON (*C. A.*)

46. Preparation of sols of silicic acid and tungsten hydroxide with the help of the Hildebrand cell. M. KRÖGER. *Kolloid-Z.*, **30**, 16–8(1922).—The sols were prepd.

by electrolyzing solns. of the Na salts using a Hg cathode. The current decreased steadily as the electrolysis progressed. After 2 hrs. electrolysis at 8v. the current in a 1.5% soln. of *Na silicate* (compn. not stated, probably approx. $Na_2O.3SiO$—Abstr.) had fallen to a min. (0.08 amp.). The resulting sol, which was neutral to litmus, set in 4 weeks. When a 6% soln. became neutral, it set rapidly to a clear gel. Hydrated SiO_2 sepd. on the anode and prevented further electrolysis of a 30% soln. The prepn. of a dark brown sol of *lower hydroxides of W* from a 2% Na_2WO_4 soln. was speeded up by the addn. of 0.1 *N* HCl. If any excess of acid were added, *W blue* was formed. A less stable gray sol similar to the brown one resulted when the Pt cathode in the electrolysis of acidified soln. of *pertungstates* was covered with a rubber diaphragm. *Hydroxides of Al, Cr,* and *Mo* pptd. during electrolysis in the *Hildebrand cell.* WM. STERICKER (*C. A.*)

47. The influence of tungstic acid on the gelatinization of silicic acid in strong hydrochloric acid solution. M. KRÖGER. *Kolloid-Z.*, **30**, 18–9(1922).—The *setting time of silica gels* formed by the mixt. of 9.77 *N* HCl and Na silicate soln. (33.7% SiO_2, % Na_2O not stated) was decreased by the addn. of a 10% soln. of $Na_2WO_4.H_2O$. The decrease was not proportional to the amt. of tungstate soln. added. W. S. (*C. A.*)

48. Electroadsorption as a purely chemical phenomenon. I. M. KOLTHOFF. *Kolloid-Z.*, **30**, 35–44(1922).—The adsorption of ions by solids (or the dispersed phase of suspensoids) is regarded as strictly a chem. reaction in which one ion of a very slightly sol. salt is replaced by another ion to form a second difficultly sol. salt. The process is strictly analogous to the exchange of bases in permutite. Freundlich's equation for the adsorption isotherm, $x/m = \alpha c^{1/n}$ (x/m is the amt. adsorbed per unit of adsorbent, c the final concn. of adsorbed ion in the soln., α and $1/n$ consts.) can be developed in which α depends upon the soly. products of the 2 difficultly sol. salts and $1/n$ is inversely proportional to the valence of the adsorbed ion. Data of Freundlich, Odèn, and the author are given to show that the values of $1/n$ for ions with valences of 1, 2 and 3 are as 1: $^1/_2$:$^1/_3$. F. L. BROWNE (*C. A.*)

49. Clay as an ampholyte. O. ARRHENIUS. *J. Am. Chem. Soc.*, **44**, 521–4(1922).—Clay, irrespective of its source, acts as an amphoteric electrolyte. The theoretical and practical importance of this is briefly discussed. H. JERMAIN CREIGHTON (*C. A.*)

50. New method for the volumetric determination of copper. S. MINOVICI AND A. IONESCU. *Bul. soc. chim. Romania*, **3**, 89–93(1921).—The method depends upon the pptn. of $Cu(NH_3)_4SO_4$ by the addition of 8 vols. of alc. to the concd. ammoniacal soln. and the titration of the ppt. with standard H_2SO_4 soln., methyl red being used as indicator. $Cu(NH_3)_4SO_4 + 2\ H_2SO_4 \longrightarrow 2(NH_4)_2SO_4 + CuSO_4$. W. T. H. (*C. A.*)

51. Methods of investigation at the Institute for Colloidal Research in Frankfort a. M. III. Investigation of preparations of colloidal silicic acid. ANON. *Chem.-Ztg.*, **45**, 1249–50(1921); cf. *C. A.*, **14**, 2574.—Prepns. of colloidal silicic acid which are sold for therapeutic use, such as in pulmonary tuberculosis, were investigated. The ultramicroscope furnished no information on the degree of dispersion of sols. of silicic acid. By the use of Kleinmann's nephelometer a relative value for the degree of dispersion was possible. Quant. relations were obtained by ultrafiltration. By this means the mixt. of differently dispersed particles was fractionated and compared with sols. of known degree of dispersion in order to obtain the abs. size of the particles.

H. M. MCLAUGHLIN (*C. A.*)

52. Heat transfer. W. H. MCADAMS AND T. H. FROST. *J. Ind. Eng. Chem.*, **14**, 13–8(1922).—Deals with conduction and convection only. Customary engineering formulas are often faulty; heat transfer is usually through 2 surfaces and a solid body and these 3 parts are differently affected by most changes of condition, hence they must be separately calcd. and not lumped together, as is often done. The leakage at a fluid-solid surface is conveniently treated by referring it to a *film* of the fluid, whose general

characteristics are discussed. New data are given showing the *properties* and *behavior* of this *film* for *condensing steam*. H. F. Weber's rule for the *thermal cond. of liquids* is tested for 13 liquids, and found consistent to 7%. W. P. WHITE (*C. A.*)

53. **Rates of adsorption and heat transfer between gases and liquids.** W. G. WHITMAN AND J. L. KEATS. *J. Ind. Eng. Chem.*, **14**, 186–91(1922).—The theory of the rate of transfer of heat and absorbable matter between liquids and gases is given, in which it is pointed out that this rate varies directly with the active vol., the driving potential, and the transfer coeff. These transfer coeffs. depend also upon the type of equipment and operating variables, such as gas velocity, liquor rate, etc. Exptl. values for these coeffs. were detd. on several types of equipment. From an economic standpoint, however, other factors must be considered in the design and operation of equipment.

E. N. B. (*C. A.*)

54. **Reduced temperatures of transition and of fusion.** J. NARBUTT. *Physik. Z.*, **21**, 341–9(1920).—A preliminary paper. By mathematical analysis several relations are developed concerning the phys. state of compds. With the various functions designated by symbols as follows: Θ = abs. temp. of transition or m.p. at the triple point; U_μ = the corresponding heat of fusion and transition; T = the abs. temp. chosen; A_T = free energy of transition; U' = heat of transition; U'' = heat of fusion; Θ' = temp. of transition; Θ'' = temp. of fusion; p_1 = vapor pressure of the solid; p_2 = vapor pressure of the liquid; $\phi = T/\Theta$; R = a const. in the well-known relation $A = RT \log p_2/p_1$ and S = the entropy, there are developed the following relations:
(1) $A'_{T'}/U'_{\Theta'} = A''_{T''}/U''_{\Theta''}$; (2) $U'_{T'}/U'_{\Theta'} = U''_{T''}/U''_{\Theta''}$; (3) $A'_{T'}/\Theta' = A''_{T''}/\Theta''$; (4) $U'_{T'}/\Theta' = U''_{T''}/\Theta''$; (5) $U_\Theta = [2\ R\Theta\vartheta/(1 - \vartheta^2)] \times \log\ (p_2/p_1)$; (6) $\sqrt[S''_{\Theta''}]{p_2'/p_1'} = \sqrt[S''_{\Theta''}]{p_2''/p_1''}$; (7) $p_2'/p_1' = p_2''/p_1''$.

C. C. DAVIS (*C. A.*)

55. **Determination of surface tension from the rise in capillary tubes.** S. SUGDEN. *J. Chem. Soc.*, **119**, 1483–92(1921).—In the detn. of surface tension from the rise in capillary tubes, it has been considered necessary to use a reference tube sufficiently large to give a plane surface. S. used two small tubes of different diameters and calcd. the surface tension from the difference in the heights of rise in the two tubes. The equation is $2\gamma[(1/b_1) - (1/b_2)] = Hg(D - d)$ where γ is the surface tension, b_1 and b_2 are the radii of curvature of the lowest points of the two menisci, H is the difference in level of the lowest points of the two menisci, g is the acceleration due to gravity and $(D - d)$ the difference between the density of the liquid and that of the surrounding medium. A table of corrections for use with this method is given and its use explained. The method is accurate to about 0.3%. The advantage of the method is that only small quantities of liquid are required. F. E. BROWN (*C. A.*)

56. **The law of distribution of particles in colloid solution.** E. F. BURTON AND MISS E. BISHOP. *Proc. Roy. Soc.* (London), **100A**, 414–9(1922).—After a Cu colloidal soln. was allowed to stand undisturbed for 50 days in a room which varied little in temp., the Cu was found to be uniformly distributed throughout the body of the liquid. These expts. indicate that the variation in concn. at different depths expressed in Perrin's distribution law must be confined to a very small distance at the surface.

H. M. McL. (*C. A.*)

57. **General conditions of the validity of the principle of Le Chatelier.** A. J. LOTKA. *Proc. Am. Acad. Arts Sci.*, **57**, 21–37(1922).—By a general method of proof not depending on the laws of energy but only on considerations involving rates, it is proved that for isolated systems of const. mass the principle of Le Chatelier holds if the addn. of a small amt. of a component disappearing in the transformation of the system, or the subtrac-

tion of a small amt. of a component increasing in the transformation, increases the rate of the transformation. If the reverse is true, Le Chatelier's principle does not hold. This condition takes a somewhat more complicated form in case outside forces are active.

F. R. B. (*C. A.*)

58. Theory of adsorption processes. A. Eucken. *Z. Elektrochem.*, **28**, 6–16(1922). —A theoretical study and mathematical analysis of adsorption phenomena and adsorption curves. This method offers a commensurate and direct means of ascertaining the action between different mols. The results of Langmuir's investigation of the adsorption of gases by glass, mica and Pt (cf. *C. A.*, **12**, 2152) are discussed at length.

H. Jermain Creighton (*C. A.*)

59. A new iodometric method for the determination of copper. R. Lang. *Z. anorg. allgem. Chem.*, **120**, 181–202(1922).—The usual iodometric detn. of Cu depends upon the reduction of Cu by iodide and titration of the I_2 that is liberated. The new method depends upon the oxidation of $Cu_2(SCN)_2$ by standard I soln. and titration of the excess of I with $Na_2S_2O_3$, the cupric ions being removed by the formation of Cu-oxalate complex which is not reduced by iodide under the prevailing conditions. Two methods for carrying out the analysis are described. (1) To the soln. contg. not more than 0.28 g. Cu and a little mineral acid, add an excess of H_2SO_3 and of 0.1 *N* KCNS until all the Cu is pptd. as $Cu_2(CNS)_2$. Boil off the excess SO_2, cool, add 120–150 cc. of an oxalate mixt. prepd. by mixing 5 vols. of 0.32 *N* $(NH_4)_2C_2O_4$ and 7 vols. of 0.95 *N* $H_2C_2O_4$ and dil. to about 400 cc. While rotating the contents of the Erlenmeyer flask, add 0.1 *N* I soln. until the cuprous ppt. is entirely dissolved and then titrate the excess of I_2 with $Na_2S_2O_3$ soln. (2) To the Cu soln. in a long-necked flask, add NH_4OH until ammoniacal and discharge the color with 0.5 *N* KCN soln. Add 1 g. of NH_4CNS and, while cooling, make the soln. acid with 0.95 *N* $H_2C_2O_4$ soln., which causes the pptn. of $Cu_2(SCN)_2$ to be analyzed as in Method 1. Method 1 is applicable in the presence of all cations which are not reduced to metal by H_2SO_3. Method 2 is applicable in the presence of all other metals with the following modifications: *Ag.*—The pptn. of AgI tends to prevent the dissolving of the $Cu_2(SCN)_2$ so that the contents of the flask should be shaken a long time before titrating the excess of I_2. *Hg.*—In many cases it is necessary to add additional NH_4CNS to dissolve HgI_2. *Pb.*—The pptn. of $PbSO_4$ is prevented by $AcONH_4$ and by using AcOH instead of $H_2C_2O_4$. First add Rochelle salt to the Cu soln., make strongly ammoniacal, decolorized with KCN, add NH_4CNS and acidify with AcOH. *Bi.*—Proceed as with Pb but acidify with oxalic acid and shake well before the final titration. *As.*—Acidify with AcOH. *Sb.*—Make the soln. strongly ammoniacal, add $(NH_4)_2C_2O_4$ or $Na_4P_2O_7$ and heat to convert the quinquevalent Sb into a sol. complex. Then proceed as with Cu alone. *Co.*—After the decolorization with KCN boil to decompose the H_2O_2 formed during the production of the complex $Co(CN)_6^{---}$. *Mn.*—Instead of adding NH_4OH, it is necessary to add Rochelle salt or $(NH_4)_2C_2O_4$ to prevent pptn. of $Mn(OH)_2$ and to avoid an excess of KCN. *Ba, Sr, Ca* and *Mg* may give ppts.; these will not form, however, if an excess of Rochelle salt is used instead of NH_4OH and AcOH is used instead of oxalic acid; the soln. should be well shaken before the final titration.

W. T. H. (*C. A.*)

60. Volumetric and gravimetric determination of zinc. S. Urbasch. *Chem.-Ztg.*, **46**, 97–99, 101–3, 125–7, 133–4, 138–9(1922); cf. *Ceram. Abs.*, **1**, 174(1922).—As a result of a critical study of the various methods commonly used for the detn. of Zn, the following procedure is recommended: Treat 1.5 g. of the finely powdered ore in a 300-cc. beaker with 20 cc. of concd. HCl. Heat until disintegrated, add 3 cc. or less of concd. HNO_3 and again heat. Add 16 cc. of 18 *N* H_2SO_4 and heat on the sand bath until nitrous fumes are all expelled and most of the HCl is evapd. Add HF drop by drop until the SiO_2 gel is all dissolved and then evap. to fumes. Cool, add 60 cc. of water and digest about 15

min. at 60–70°. Sat. with H_2S, filter and wash with a mixt. of 80 cc. hot water, 2 cc. 18 *N* H_2SO_4 and 20 cc. of satd. H_2S soln., using this wash liquid in 10–15-cc. portions. The filtrate should not exceed 180 cc. Boil off H_2S, adding a little coarse sand to prevent bumping. Add 3–5 cc. of H_2O_2 to oxidize the Fe and heat 5 min. to remove excess of oxidizer (if Mn is present add 0.5–2 g. of Br. and shake). Add 20 g. NH_4Cl and an excess of NH_4OH. Make up to exactly 300 cc., filter and use 100 cc. of the filtrate (0.5 g. of ore). Evap. gently until all the NH_4OH is expelled, add 1 drop of methyl orange and neutralize carefully with HCl. Heat to boiling, dil. to 150 cc., add 3 cc. of $FeCl_3$ soln. contg. 0.1 g. of Fe per 1. and titrate the hot soln. with $K_4Fe(CN)_6$ until the blue color changes to white, and then titrate back to a pale blue with standard Zn soln. In the study of the gravimetric detn. of Zn, no attention was paid to the detn. as phosphate. The expts. showed, however, that it is possible to ppt. Zn quant. as ZnS from a soln. originally neutral and contg. as much as 3.1 g. of $ZnCl_2$ or 7.5 g. of $ZnSO_4$. If the soln. contains 1 cc. of *N* HCl per 100 cc. and from 0.15 to 0.2 g. of Zn the pptn. as ZnS is quant. and the ppt. easy to filter. The presence of NH_4 salt appeared to retard the pptn. Satg. with H_2S in the cold and then heating the stoppered flask to about 40° served to aid pptn. The presence of Al retarded the pptn. of ZnS but pptn. in the presence of HCOOH seemed to be favorable as has been found by others. W. T. H. (*C. A.*)

61. The form of silicon: Solubility of silicon in hydrofluoric acid. W. Manchot and H. Funk. *Z. anorg. allgem. Chem.*, **120**, 277–99(1922); cf. *C. A.*, **16**, 1055.—Alloys of Al-Si were prepd. in the form of reguli by heating Al with K_2SiF_6, and dilg. with Al, or by direct fusion of Al and Si. Samples were then heated to various temps. for 15–20 min., and one series allowed to cool in the furnace as slowly as possible, another series being poured into H_2O to secure instant cooling. Al was dissolved out by HCl, the residue dried at 80° and weighed, giving the % of Si, and the latter then treated at 120° with 40% HF in a closed Pt vessel, with side tubes for introducing CO_2 and for carrying off the H evolved. Detns. of H showed that from 1.9 to 47.5% of the theoretical vol. of gas was formed, based on the % of Si in the sample, when the melts had been quickly cooled, and that only from 0 to 6.5% of the theoretical vol. of H came from slowly cooled samples. The latter were graphitic, and bluish gray, the single crystals being steel blue or slate blue, and yellowish brown in thin sections by reflected light. The quickly cooled samples were blackish gray, with a brownish tone, and showed no crystn. with a magnification of 960 diams. In water some of the particles showed the Brownian movement, having a diam. of 1 μ or less. A few quickly cooled specimens showed incipient crystn., probably due to the fact that the quenching was occasionally delayed slightly. Melts contg. less than 10% of Si gave more H than more concd. melts. Heating to different temps. had little effect. Very fine pulverizing of both sorts of Si caused a slightly increased H vol., but when the crystd. variety was reduced to particles about 1 μ in diam., the action of HF was still slight. No samples were completely sol. in HF. Amorphous Si left a brown residue which was only slightly attacked on subsequent exposure. All 3 varieties were also slightly attacked by H_2O, the amorphous samples giving up to 1.1% of H, and the crystd samples only traces. The insol. residue from the amorphous variety was a very reactive brown powder, burning when heated in air or O, igniting with fuming HNO_3, Cl and Br, and giving H with dil. NaOH. This behavior is due to traces of occluded H, which can be driven off at a dull red heat, leaving a dark residue which resumes its brown color on cooling, but which has lost its reactivity. Heating *in vacuo* gave 32–44 cc. of H per g. The brown variety is best prepd. from melts contg. 10% of Si. D. of a quickly cooled sample 2.23, d. of brown variety 2.2, d. of crystd. variety 2.3. The best method for the *detn. of Si content* was found to be measurement of the H evolved on treatment with boiling KOH soln., the gas being driven over by CO_2. Amorphous samples contained 75–88% of Si, some-

what less than the crystd. variety, and slightly more SiO_2, produced by removing the melts from the furnace and quenching. The residue after treatment of the amorphous Si and HF also contains some SiO_2, evidently produced by cyclic reactions involving SiF_4 and H_2O. When 25 g. of crystd. Si was treated 21 times for 4 hrs. each with HF, the wt. was reduced to 2 g., the crystals lost their luster, and the residue was an almost amorphous powder, which, however, under the microscope still showed crystal forms. Consequently even crystd. Si is slowly but practically completely sol. in HF. Moissan and Siemens (*Ber.*, **37**, 2540(1904)) prepd. crystd. Si from Ag melts, which was 99% sol. in HF, and formed thin yellow transparent or translucent plates. But M. and F. found that black crystd. Si from slowly cooled Ag melts gave very little H with HF, while quenched Ag melts gave completely amorphous Si which easily evolved H. M. and S. state also that the rapidity of cooling has no influence on the yield of Si sol. in HF, and do not appear to have noted that H is formed. Their high Si contents were probably due to their method of analysis, which consisted in dissolving the samples in 10% KOH and weighing the SiO_2 formed, no statement appearing as to a correction for the SiO_2 already present. M. and S. apparently did not prep. the amorphous Si formed in rapidly cooled Ag melts. To test M. and S.'s statement that melts containing not more than 2% Si gave a product completely sol. in HF, 2 melts containing 2 g. of pure Si and 50 g. of Ag were prepd., heated to 1500°, one of them cooled slowly, and the other poured in H_2O. Each gave, after soln. of Ag in dil. HNO_3, 0.5 g. of Si. That from the quenched melt was a very voluminous brown powder, showing no crystn. under a magnification of 960, and agreeing in properties with that prepd. from Al melts. The slowly cooled melt gave a much less voluminous gray, cryst. powder. Heated in HF for 1 hr. at 120°, the amorphous Si, 70% pure, gave 15.1% of H, while the cryst. powder, 85.2% pure, gave only 8.2% of H. Expts. with Zn and Pb melts (with O. Köhler) also gave amorphous Si which was more reactive than the slowly cooled cryst. form, but the amt. of H evolved with HF was relatively lower than in samples formed in Al or Ag melts, owing to the lower soly. of Si in Zn and Pb, which favors crystal formation even with rapid cooling. Si prepd. by Kühne's method from SiO_2, Al and S, after treatment with boiling HCl to remove Al, was crystd. and gave only 2.7% of H. Technical massive Si gave 3% of H when quenched in H_2O from 2000°, and 2.1% when slowly cooled, and similar results were obtained with pure Si, all the samples being crystd. after cooling. Amorphous Si, both before and after treatment with HF, can be changed into crystd. Si by soln. in Al. So-called "amorphous" Si prepd. by reduction of quartz with Mg gave very little H, and the microscope showed it to be cryst. M. and F. conclude that their amorphous Si is not an allotropic modification, but is an extremely finely divided form of crystd. Si, which cannot be produced by mech. means, although it can be approached by fine grinding. The brown amorphous variety, which is resistant to HF, is thought to possess a kind of passivity due to the occluded H. M. R. Schmidt (*C. A.*)

Refractories and Furnaces

62. Apparatus for the determination of deformation of refractories under load. Dr. W. Steger. *Ber. der. Deut. Keram. Gesellschaft*, **31** (1922).—The writer reviews previous methods of testing refrac. under load and describes his app. This app. is independent of the fur. and is portable. Heat is obtained elec. and the expansion or contraction of the specimen is recorded automatically. R. F. G.

63. Silica brick of constant volume. O. Rebuffat. *Trans. Ceram. Soc.*, **21**, Pt. 1, 66–68(1921–1922) (R. Rieke).—The writer gives data showing effect of small percentages of P_2O_3 on the inversion of quartz to tridymite. It is shown that 0.31–0.45% P_2O_3 is sufficient to effect a lowering of the sp. gr. from 2.65–2.60 to 2.25–2.30 in a single burn of 8 hours at 1300–1350°C. R. F. G.

64. **Behavior of refractory brick under load at high temperatures.** Dr. K. Endell. *Trans. Ger. Ceram. Soc.*, 2, 73(1921).—Cylinders of refrac. material 2″ diam. and 2″ high are heated to 1700°C in an elec. resist. furnace and pressure is applied by means of a suitable lever arrangement. Four different types of refrac. tested in this way compare as follows: 1. *Clay Brick*—Initial softening point about 1300° C. If plastic clay content is high may be lowered to 1150° C. 2. *Magnesite Brick*—Initial softening point about 1500° C. 3. *Silica Brick*—Short softening range commences about 1650° C and shortly thereafter collapses, whereas magnesite brick even at 1700° C. still shows a certain degree of stability. 4. *Carbon brick*—No signs of softening up to 1700° C.

F. A. Whitaker

65. **The development of a new refractory.** A. F. Greaves-Walker. *J. Soc. Chem. Ind.*, 41, 13–14T(1922).—Quantity production of sillimanite brick has already commenced. Analysis of brick is: SiO_2, 6.32; Al_2O_3, 86.10; Fe_2O_3, 1.17; CaO, 0.60; alkalies 1.10; TiO_2, 4.53%. Pure sillimanite is 37 SiO_2, 63 Al_2O_3 with fusion temp. at 1816°. The brick compare favorably with SiC under the same conditions.

R. R. Danielson (*C. A.*)

66. **Retorts for zinc ores.** J. P. Varian. *Eng. Mining J.*, 113, 363(1922).—V. recommends sizing of grog to minimize voids. Each grain of grog must be coated with a thin film of clay and to accomplish this the clay is soaked with H_2O in a large tank to form a thin mud. The tank should have a mixing device and sized grog should be added in definite amts.

R. R. Danielson (*C. A.*)

67. **The determination of the thermal conductivity, specific heat, density and thermal expansion of different rocks and refractory materials.** Y. Tadokoro. *Science Repts. Tôhoku Imp. Univ.*, 10, 339–410(1921).—This extensive report covering 109 specimens of Japanese and Asian rocks and refractory materials contains 18 tables and 45 figures. For detg. the thermal cond. the test-specimen is periodically heated and cooled and the penetration of the temp. wave into the interior measured, the diffusibility being calcd. by means of Fourier's series. A purely sinusoidal heat source was devised using a variable resistance in a plectrum form. This and the methods for the other properties are described in great detail. The cond. increases with content of magnesia, but decreases with that of silica, lime and alumina. Densities are calcd. from the coeffs. of expansion. Silica bricks are most suitable for installation of a reservoir of heat, the temp. of which is required to rise as quickly as possible when hot gas comes into it, and to cool quickly when cold air comes in. Chamotte bricks are most suitable for thermal insulation.

G. L. Clark (*C. A.*)

68. **New seven-ton Heroult furnace.** Anon. *Iron Age*, 109, 325(1922).—The furnace described departs from the standard types, in that the lift of the electrodes is extremely high and makes possible the use of mech. charging devices.

Louis Jordan (*C. A.*)

69. **Acid open-hearth process for manufacture of gun steels and fine steels.** W. P. Barba and H. M. Howe. *Trans. Am. Inst. Mining Eng.*, sep. No. **1114-S**, 39 pp. (1922); *Blast Furnace Steel Plant*, 10, 183–91.—Report of the Committee on Steel Ingots of the Engineering Division of the Natl. Research Council. The paper is a detailed description of the best practice in steel melting and ingot production. It was prepared in order that the number of efficient makes of steel for guns, shells, crankshafts and other forgings might be increased to meet gov't needs in 1918. Publication has been delayed. Reasons are given for each step recommended for the production of sound, clean and uniform ingots of proper structure and for prolonging the life of the furnace. The report is a concise manual which will be of great value to all who wish to make fine steel. Means for restraining segregation, columnar crystn., retention of inclusions, and for preventing internal and external cracks or flakes are given. The advantages of cool

over hot pouring are stated. Ingot mold design is treated in detail. The reasons for the use of top or bottom pouring are clearly stated. The time-temp. diagram on p. 8 and the ingot mold data on pp. 31–39 are important parts of this excellent manual.

JAS. O. HANDY (*C. A.*)

70. Reduction of fuel wastes in the steel industries. F. G. CUTLER. *Mech. Eng.*, **44**, 237–8(1922).—Formulas are given for the calcn. of blast required and gas obtainable in the iron blast-furnace operations. The volume of gas possible = 71.4 *R*, in which *R* is lbs. of coke per t. of pig iron, the B.t.u. value of the gas = 62.5 ÷ 0.0165 *R* and the cu. ft. of air per lb. of coke = 51.4 *R*. The wastes such as the gas and coke braize are utilized at the plant. The gas from the furnace is burned under the boilers and used for the heating of the stoves, the gas from the coke plant is sold and the tars and oils recovered are used as fuel for the open-hearth furnaces, the coke braize is used as a cover for the molten metal when being transported from place to place about the plant. A heat balance for the manuf. of 1 t. pig iron is outlined which shows a total of 17,375,000 B.t.u. required. W. A. MUELLER (*C. A.*)

71. Zirconium and zirconium oxide. L. ANDRIEUX. *Industrie chimique*, **8**, 478–81 (1922).—A review of the occurrence, properties, and applications of ZrO_2, and of the prepn., properties, and applications of Zr, with a bibliography of 21 references.

A. P.-C. (*C. A.*)

72. Calculation of working temperature in metallurgical furnaces. HUGO BANSEN. *Stahl u. Eisen*, **42**, 245–53, 291–7, 370–5, 423–6(1922).—The ratio of the actual working temp. of a furnace to that calcd. from the heat input and the heat capacity and temp. of the products of combustion is 0.65–0.80°. For the heat to be transferred from the flame to the work a temp. difference of 50–300° is necessary. R. S. DEAN (*C. A.*)

73. The present status of electric furnaces in steel making. HARRY ETCHELLS. *West Scotland Iron & Steel Inst.*, **29**, part 2, 2–12(1921).—A review. The many advantages of elec. steel are emphasized. Discussion by Jefferson, Sharpe, *et al.*

C. G. F. (*C. A.*)

74. Aluminium. P. H. SAMPELAYO. *Bol. del. inst. geol. de España*, **41**, 3(1921); *Bull. Imp. Inst.*, **19**, 233–6.—Various deposits of bauxite are described. The bauxite problem in Spain is still under investigation. The % of SiO_2 is high so that the mineral can be used only for obtaining $Al_2(SO_4)_3$, as a refractory or as a building stone. A typical analysis is: SiO_2 9.40, TiO_2 0.96, Fe_2O_3 7.0, Al_2O_3 68.19, CaO 0.4, MgO 0.10, loss 14.10%. R. L. SIBLEY (*C. A.*)

75. A new electric muffle furnace for temperatures up to 1700°. K. ENDELL. *Z. angew. Chem.*, **35**, 31(1922).—The oven is 285 × 185 × 110 mm. inside, uses a.c. or d.c., can be heated to 1700° in 2 hrs. and held within 10° of any desired temp., the temp. is uniform, the power required is 5–16 kw., and repairs are easily made.

J. H. MOORE (*C. A.*)

76. Laboratory furnace for deformation temperature of refractories. L. R. OFFICE. *Chem. Met. Eng.*, **25**, 162–3(1922).—A small pot furnace is described with drawings. Natural gas at $2^1/_2$ lbs. and preheated air at 25–30 lbs. pressure will give cone 35 in 45 min. The preheater and burner are the special features. R. J. MONTGOMERY (*C. A.*)

77. American coking practice. J. W. LEE AND G. A. HEBDEN. *Iron & Coal Trades Rev.*, **104**, 310–11(1922); *Gas World*, **76**, No. 1963 (Coking Sec.), 10–14.—An account of a 2-months' tour in the U. S. visiting 25 coking plants. J. L. W. (*C. A.*)

78. Refractories source of troubles. M. L. MORRISON. *Foundry*, **50**, 33–5(1922). —The blow holes in cast iron attributed to overheating may, in some cases, be caused by the decompn. by water present in the molding sand of carbides of Al and Ca formed by reactions between the melt and the refractories. Careful selection of the refractories used in the cupola lessens this damage. F. P. FLAGG (*C. A.*)

PATENTS

79. Refractory brick. George A. Balz. U. S. 1,410,729, March 28, 1922. A refrac. brick consisting of a body portion and a facing portion rel. shaped to mech. engage one another and united only by such engagement. C. M. S., Jr.

80. Refractory brick. J. A. Wright. Can. 215,847, Feb. 14, 1922. Refractory bricks are made from natural deposits of chromite and serpentine rock by crushing, agitating with slight moisture to distribute the serpentine particles evenly throughout the chromite and then burning in a kiln. (*C. A.*)

81. Electric furnaces. A. E. Reid. Can. 215,822, Feb. 14, 1922. A furnace especially adapted for making *carbide* has an outlet in the furnace chamber which is kept in its open or delivering condition by passing current through an electrode placed in the outlet. Means for feeding a charge to the furnace and electrodes for delivering current to the charge are provided. (*C. A.*)

82. Refractory composition. Daniel Elijah Collins. U. S. 1,411,842, April 4, 1922. A refrac. bonding and glazing compn. comprising fire clay, a hydraulic cement and a metallic sulfide. C. M. S., Jr.

Stoneware, Whiteware and Porcelain

83. Making of stanniferous faience. Alix. Cornille. *Rev. Mat. Constr. Trav. Pub.*, **150**, 35B–38B(1922).—General description of the body and glazes from the points of view of compn. making, and burning, for faience containing tin oxide. The body is usually a mixt. of clay, an argillaceous marl, and an argillaceous or calcareous sand. Compn. limits are SiO_2 55–65%, Al_2O_3 13–20%, Fe_2O_3 2–4%, MgO CaO 13–25%, KNaO 2–4%. A lime content less than 14% gives rise to cracking, that higher than 22%, to scaling and staining. The propn. of lime is influenced by the content of other bases, *i. e.*, MgO, alkalies and Fe_2O_3; their presence necessitating a decrease in CaO. Also the higher the temp. of burning the lower should be the lime content. A glaze corresponding to $\left.\begin{matrix}0.59\ PbO\\0.40\ Na_2O\end{matrix}\right\}$ 0.15 Al_2O_3, 0.26 SnO_2, 2.45 SiO_2 will stand cone 011. For colored glazes, a mixt. of 1 part of tin glaze and 4 parts of transparent glaze is used as the base, the coloring oxides being added or fritted to the one or the other as the case may require. The formula of the clear glaze is

$$\left.\begin{matrix}0.2\ KNaO\\0.1\ CaO\\0.65\ PbO\end{matrix}\right\}\quad\left.\begin{matrix}0.2\ B_2O_3\\0.1\ Al_2O_3\end{matrix}\right\}\quad 1.1\ SiO_2$$

A clear *tin-less opaque glaze* with which good results have been obtained corresponds to the formula

$$\left.\begin{matrix}0.8\ RO\ (Pb, Ca, Mg)\\0.2\ R_2O\ (K,Na)\end{matrix}\right\}\quad\left.\begin{matrix}0.22\ B_2O_3\\0.07\ Al_2O_3\end{matrix}\right\}\quad 2.08\ SiO_2$$

Louis Navias

84. Testing porcelain, kaolin and clay for whiteness. Dr. W. Funk, *Trans. Ger. Ceram. Soc.*, **2**, 39(1921).—The nearest approach to a "standard white" surface which reflects 100% of the light rays can be prepd. from precipitated barium sulphate. For comparing "whites" a "grey" scale of color strips ranging from "standard white" to black is described. This scale is in the form of a long stencil strip with cut-outs between the bands of shades and can be placed over the piece until the shade of the test-piece corresponds with that of the strip. Percentage of "white" in a yellow tinted piece can be determined with the same scale if filtered light is used. Percentage of "white" in porcelain ranges from 70 to 95%. F. A. Whitaker

85. Handling Equipment. U. Sauer, *Trans. Ger. Ceram. Soc.*, **2**, 66(1921).—Describes advantages of monorail system and gravity elevator for handling raw and finished materials, also a portable conveyor for handling saggers in and out of kilns.
F. A. Whitaker

86. High fire porcelain glazes. H. H. Sortwell. *Brick and Clay Record*, **60**, 622–625(1922). H. G. Schurecht

87. Comparison of cold glazes and cold glazed tile with ceramic wall tile. C. Tostman. *Ber. der Deut. Keram. Gesellschaft*, **3**, Pt. 1, 31(1922).—T. gives short résumé of patents on cold glazes and of previous lab. tests of this material. Objects to term *glaze* for this product which is composed of Portland cement, color and a lime soap. The tile are prepared by coating a concrete base with this paint. T. gives detailed description of tests and data obtained by detn. of porosity, resistance to freezing, transverse strength, impact test, resistance to chem. and hardness of glaze on both the concrete and ceramic wall tile. The ceramic tile were the usual product of white burning body and translucent glaze. From his own and previous exp. the writer concludes that the cements are a possible substitute for common oil paints as a wall covering but that they are inferior to ceramic tile in every way. The writer expresses his fear that the cheapness and ease of manuf. of this substitute product will lead to its being placed on the market in such quantity as to hurt the wall tile industry. R. F. G.

88. The testing of porcelain. Dr. R. Rieke and Dr. M. Gary. *Ber. der Deut. Keram. Gesellschaft*, **3**, Pt. I, 5(1922).—Growing importance of tests is noted and history given of the formation of a committee, as a branch of the Ger. Soc. of Testing Materials, for the adaptation of standard tests to the study of porcelains (especially elec. porcelain). Detailed descriptions of tensile, ball compression (cold), transverse and impact bending tests are given together with a tabulation of results obtained on eight porcelains. The reliability of the tests are calcd., their comparative value as means for differentiating porcelains found, and the conclusion reached that the ball compression test be further developed as a means for classifying elec. porcelains. Absorption tests (American method of dye penetration) produced no positive results but a modified method was adopted because of the use of this test in other countries. Porosity (both open and closed pores) and the microscopic structure of the eight porcelains were also studied. It was found that altho no definite reln. existed between mech. strength and microscopic structure there was sufficient connection to warrant further study in order that microscopic analyses might be established as a definite and simple means of classifying porcelains. R. F. G.

PATENT

89. Ceramic insulating material. Joseph A. Jeffery. U. S. 1,409,953, March 21, 1922. The raw batch of a ceram. material comprising a mixt. of sillimanite, a flux and a clay mixt., the clay content, when heated by itself, maturing at the temp. at which the ceramic body matures. C. M. S., Jr.

Art and Design

90. A proposed standard method of colorimetry. H. E. Ives. *J. Optical Soc. Am.*, **5**, 469–78(1921).—A spectrophotometric method of color measurement is suggested, which consists in measuring adjacent patches of the spectrum, each patch being of width inversely proportional to the hue perception sensibility of the eye at that point and so narrow that no significant color difference can enter because of differences of intensity distribution in the spectra of the compared colors. The advantages over the 3-element methods or other spectrophotometric processes are discussed. As an instrument the principle of the Maxwell color box is used, with specially designed slits. Light from the surface whose color is to be measured, and from a standard white surface under

the same illumination passes through the special slits and 2 lenses placed at their focal distances from the slits. Next is placed a compound photometric prism designed to reflect the light from one lens through one part of the field as viewed by the eye of the observer, and light from the other lens through another part, the dividing edge being as fine as possible. Finally, in order, are a dispersing prism or grating, telescope lens, and narrow viewing slit. To make a photometric match a variable aperture sector is placed before the white-light slit, and the process of making a measurement consists in isolating the successive monochromatic patches, and for each one varying the sector transmission until photometric match is obtained. The method of plotting the results and of reproducing the measured color by a spectrum template disk are fully discussed.

G. L. CLARK (*C. A.*)

91. The use of secondary reference standards in process problems of color measurement. H. S. BUSBY. *Proc. Am. Soc. Testing Materials*, **21**, 1139–53(1921).—A *colorimeter* is described which uses rotating sectors of suitable standard colors or white, similar to the Howland color photometer (*C. A.*, **10**, 2164), but in which the abs. or relative areas of the sectors may be varied or read off while the machine rotates. Color matches may, therefore, be made very rapidly; duplicate measurement agree within sector areas to 0.1% of the total sector circle. For commercial work, secondary reference standards are sufficiently accurate and more easily applied than fundamental standards.

F. A. WERTZ (*C. A.*)

92. Dark colored pipe from fire clay. ANON. *Brick and Clay Record*, **60**, 546(1922).—To aid in bringing about the dark colored pipe alternating oxidizing and reducing conditions should be used. A dull black glaze has been made by mixing crude oil with the salt. The fire immediately before salting should be clear and bright. After the salting the kiln should be fired with reducing conditions, and then oxidizing before salting again. If this scheme is followed several times it facilitates the formation of desirable dark glazes.

H. G. SCHURECHT

93. Battle of the bricks. ANON. *Brick Pottery Trades Jour.*, **30**, 84(1922).—It is claimed by G. Skipper that houses where masters of architecture are found are made with unburned brick since they make the house warm and dry. A. B. Searle questioned the above statements and thinks burned brick are better than unburned.

H. G. SCHURECHT

94. Some ways of reducing the cost. ANON. *Clay Worker*, **77**, 40–42(1922).—Time saving devices for handling the crude clay and ware are described.

H. G. SCHURECHT

95. Paving brick variety simplified. ANON. *Clay Worker*, **77**, 38(1922).—The National Paving Brick Manuf. Assn. in coöperation with Depart. of Commerce of the U. S. and through conference with a number of organizations has been eliminating useless sizes and varieties in paving brick and simplifying standards reduced to the smallest practical number. The varieties to be retained are as follows: Plainwire-Cut Brick, Repressed Lug Brick, Vertical Fibre Lug Brick, Wire-Cut Lug Brick, and Hillside Lug Brick.

H. G. SCHURECHT

96. Preference for asphalt filler for brick pavements for general use is announced. ANON. *Clay Worker*, **77**, 38(1922).—The N. P. B. M. A. adopted asphalt filler for general use as a filler for brick pavements.

H. G. SCHURECHT

97. The determination of the porosity and resistance of clay ware to acids. O. KALLAUNER AND J. FISER. *Sprechsaal*, **54**, 412–422(1922).—The results of porosity and acid tests on 25 different ceram. bodies are given as detd. by different methods.

H. G. SCHURECHT

98. The use of $BaFl_2$ to prevent scumming. ANON. *Sprechsaal*, **54**, 547–548(1921).—Reference is made to Lovejoy's and Staley's work in *Trans. Amer. Ceram. Soc.*, **8**,

255, 17, 200. Using $BaFl_2$ in the place of other barium salts is cheaper, is more sol. than $BaCO_3$, the necessary amt. is the same or less, it does not affect the color of the fired ware, an excess does not cause scumming and it facilitates the vitrification of the mass. H. G. SCHURECHT

99. Burning with oil in Haigh kiln. HAIGH. *Brick and Clay Record*, **60**, 546–547 (1922).—The saving in fuel depends on the cost of fuel oil. Whether it is cheaper than coal or not depends on where it is being used and how cheap oil is compared with coal. The Phenix Clay Corp. use 14 gals. per 1000 brick. The Salmon Brick & Lumber Co., Slidell, La., use $52^1/_2$ gals. per 1000 brick and fire to cone 14, but they top fire with 70 bs. of fine coal per 1000 brick. H. G. SCHURECHT

100. Scumming, efflorescence and whitewash. ANON. *Brick and Clay Record*, **60**, 602–606(1922).—The causes of scumming may be (1) sol. salts in weathered clay, (2) minerals in unweathered clay which decompose, (3) sol. salts in tempering water, (4) sulphur in lubricating oils, (5) sulphur in kiln gases used for dryer heating, (6) slow drying, (7) condensation in dryer, (8) decomposition of sulphur minerals in clay during burning, (9) sulphur from fuel uniting with lime in clay, (10) condensation during water-smoking period, (11) storage on cinders or damp soil, (12) soaking of brick wall and reëlaboration, and (13) action of rain and sol. salts from mortar.

Suggestions for preventing white wash are (1) use freshly mined unweathered clay, (2) weather clay thoroly to enable washing out of sol. salts, (3) be careful as to tempering water, (4) use barium compds. to ppt. sol. salts, (5) dry ware rapidly, (6) prevent condensation in dryer, (7) do not use sulphurous gases in dryer, (8) water-smoke ware uniformly with good draft, (9) use a low sulphur fuel, (10) burn with alternating reducing and oxidizing conditions, (11) coat brick with coal tar or wheat flour, (12) burn brick hard and make impervious, (13) store brick on planks and (14) be careful in use of mortar. H. G. SCHURECHT

101. Schinkel's Berlin brick buildings. H. MACKOWSKY. *Tonind. Ztg.*, **46**, 307–309(1922).—M. describes various types of brick buildings built by Schinkel. H. G. SCHURECHT

102. Observations on burning. J. P. WILLIAMS. *Clay Worker*, **77**, 34–35(1922).—Two types of continuous kilns are described, one in which the fire moves and the ware remains still and the other in which the ware moves and the fire stands still. The ones in which the fire moves are divided into two classes, the compartment type and the tunnel type. The moving ware kiln is divided into two classes, one with a muffle and one without a muffle or what is called direct fired. The moving fire type of kiln is cheaper than the compartment type and the latter is considered better than the tunnel type, although in some of the kilns of the Hoffman type, in which the ware is fired from both top and sides, they get very good results, with but few light brick and over burnt ones. The German and English Hoffman kilns are commonly used in this country and are the best types of the straight tunnel kilns, and by far the cheapest to build, and their operating cost is about on a par with the compartment type. The prevailing type of compartment kiln used in this country has been that of the German Mendheim, and also those of P. L. Youngren. The moving fire type of kiln is becoming out of date, and a moving ware kiln will take about 10–15% less coal than the moving fire type. Also a much larger amount of ware is tied up in the kilns of the moving fire type which is expensive. Of the moving car type the muffle kilns are used for ware having a short burning range, as brick and tile, while direct fired kilns are used for wares having a larger burning range as pottery and refractories. H. G. SCHURECHT

103. Automatic stokers in brickwork. ANON. *Brick Pottery Trades Jour.*, **30**, 80(1922).—Automatic stokers for boilers are invaluable when the boilers are sufficiently large or sufficiently numerous to warrant them. Unfortunately, there is a difference of

opinion among engineers as to the smallest boiler for which it pays to install an automatic stoker, but it is generally agreed that they offer no advantage for plants of less than 150 h.p., and should not usually be installed for plants of less than 500 h.p., so that few brickworks can use them to advantage. In large power installations they are invaluable, and save at least 10% of fuel. Those brick works which profit by the use of automatic stokers do so because they enable a very poor quality of coal slack to be used which could not be employed for hand-fired boilers as the fires would require too much attention. The rate of combustion should be adjusted so that the automatic stoker gives the best results obtainable with the available coal. Sometimes, by increasing or reducing the rate of combustion, the efficiency of the automatic stoker may be greatly improved. For many purposes a rate of 25 lbs. of coal per sq. ft. of grate area is the best rate of combustion with an automatic stoker, but occasionally much higher rates are desirable, according to the coal and the boiler. H. G. SCHURECHT

104. Deposits brick in neat pile on job. ANON. *Brick and Clay Record*, **60**, 538–540 (1922).—A new brick truck with improvements for loading and unloading is described. H. G. SCHURECHT

105. Burning in a coal fired Dutch kiln. ELIAS PETTS. *Brick and Clay Record*, **60**, 533–534(1922).—In firing up draft kilns of the Dutch type P. recommends keeping fires low in beginning, keeping grates well covered and fire should be kept level. Heavy firing causes trouble and fires should be cleaned often. H. G. SCHURECHT

106. Heat conservation studies on kilns. DR. E. REUTLINGER. *Trans. Ger. Ceram. Soc.*, **2**, 33(1921).—Describing the activities of the Society of Heat Conservation Engineers with headquarters in Cologne in providing more scientific control of the burning processes in the ceramic industry. The general procedure is: 1. The study of present methods and expert suggestions for improvements. 2. Introduction of improvements and education of management and personnel to obtain best results. 3. Introduction of practical heat control methods coupled with periodic inspection. 4. Coöperation in research work covering fundamental improvements in the ceramic industry. Observations so far show the following general fundamental weaknesses: A. Burning period too long. B. Coal consumption too high. C. Quality of ware irregular. In the past too much dependence placed on the intelligence and watchfulness of the burners. F. A. W.

107. Absorption of hollow tile. ANON. *Technical News Bulletin of U. S. Bureau of Standards*, **60**, 12.—An investigation has been conducted by the Bureau of Standards to determine the difference in results obtained with various methods and their effectiveness in determining the total porosity. Specimens of the different types of clay were successively immersed in water for periods up to 9 days and in boiling water for periods up to 5 hours with detern. of rates of absorption. Similar deterns. were made under vacuum and finally the total porosity was obtained by volume and sp. gr. measurements. The results, while varying considerably between different types of clay, are in general: (1) Absorption detd. by cold water immersion does not approach near enough to complete saturation to give practical and consistent results; (2) the best practical method consists in boiling for 5 hours, cooling the water and specimens to room temperature, and allowing them to soak for 1 hour. When about 88% saturation is reached, the absorption thus deterd. is on the average 1.28 times that deterd. by immersion in cold water for 72 hours. (3) Proper treatment under vacuum will give nearly the full saturation and porosity, but the method is probably too complicated for use in acceptance tests. H. F. S.

108. Rational analysis as a plant control. DR. R. RIEKE. *Ber. der Deut. Keram. Gesellschaft.*, **3**, Pt. 1, 24(1922).—The writer reviews several methods of detg. kaolin in clay and advocates the Kallauner-Matejka procedure which permits the detern. of kaolin content in clay with good accuracy in 6–7 hrs. time. R. F. G.

109. Connection between viscosity and chemical constitution of gases. HARRY SCHMIDT. *Z. Elektrochem.*, **28**, 50–5(1922).—A mathematical paper. Proof is put forward that the mean cross-section of the mol. sphere of action in gaseous compds. (which dets. the magnitude of the coeff. of viscosity) conforms to those regularities which are derived geometrically from chem. constitution for the mean cross-section of the mol. itself. H. JERMAIN CREIGHTON (*C. A.*)

110. The manufacture of ceramite. A. E. BUCH. *Kalk, Gips u. Schamotte Ztg.*, **28**, No. 13 (July 7, 1921); *Chimie et industrie*, **7**, 101(1922).—Ceramite is an artificial product, prepd. from powdered clay and quartz sand. The mixt. is fired at cone No. 13. A stone of Hungarian origin showed: SiO_2 54, Al_2O_3 14, Fe_2O_3 8, CaO 16, and MgO 4–5. A. P.-C. (*C. A.*)

PATENTS

111. Means for making building blocks. HARRY E. CLOUSER and EDGAR R. THORNTON. U. S. 1,410,166, March 21, 1922. An app. for making building blocks comprising a support, a mold container fixed thereto, mold-pieces removably fitted in the container, the container being open ended, and arranged to receive the block material from above, means for pressing the material into the vol. included by the mold-pieces, and means for then freeing the mold from the block by a movement of the former in a horizontal plane. C. M. S., JR.

112. Processes for the manufacture of briquettes. E. POLLACSEK. E. P. 157,908, October, 1921. Briquettes are prepared by compressing in the cold state a mixture of coal dust, or rubbish or waste metals, and a binder prepared from alkaline sulphite-cellulose waste lye and mineral oil as described in E. P. 157,907.
H. Hg. (*Jour. Chem. Ind.*)

113. Apparatus for the manufacture of hollow bricks closed on all sides. AUGUST KAHR. Germany 1,411,170, March 28, 1922. In a continuous hollow brick or tile making machine, the combination with a mouth-piece through which clay is expressed: of a cylindrical rotatable core having a clay forwarding recess in its periphery and having means to conduct air to the interior of the clay string during the rotation of the core.
C. M. S., JR.

114. Twin wall brick. THOMAS W. PEIRCE. U. S. 1,410,953, March 28, 1922. A reversible channel brick of the kind described, of a width to extend from face to face of a wall, comprising two wall portions each cored longitudinally and united intermediate their height by a central web defining, with the inner faces of the wall portions, a plurality of centrally located air channels. C. M. S., JR.

115. Glass. E. C. SULLIVAN AND W. C. TAYLOR. U. S. 1,408,145, Feb. 28, 1922. A glass adapted for *making elec. lamp bulbs* is formed from SiO_2 71.9–74.5, Na_2O 20.2–21.1, Al_2O_3 0–2, CaO 2.45–2.77 and MgO 1.95–2.6%. Cf. *Ceram. Abs.*, **1**, 82(1922). (*C. A.*)

Glass

116. The stability relationships of the oxides of silicon and fused silica. RUDOLF WIETZEL. *Z. Anorg. Chem.*, **116**, 71(1921).—A 24 page article which is summed up by the author as follows: The following data were detd. exp. (1) The heat of cryst. at room temp. of cristobalite, quartz and chalcedony, measured as the difference of the heats of soln. in HF of the fused silica and the crystd. form. (2) The mean sp. hts. up to the m.p. (3) The m.p. of cristobalite as 1696°. The m.p. of quartz was *estimated* at 1600–1670°. In the case of cristobalite and quartz variations in the inversion point and in the heat of inversion were established. These were explained as due to grains of different size. It appeared that chalcedony exhibited no *unusual* SiO_2 modification

but was quartz of microcrystallin structure. The following systems were investigated in the light of Nernst's ht. theorem.

Fused Silica – Cristobalite
Fused Silica – Quartz
Cristobalite – Quartz

The calcd. A-U diag. for cristobalite-quartz is in complete harmony with the observations. Also the facts that fine grained and twinned substances possess a lower inversion point are consequent of the theory. In the systems with a "glass" phase the establishment of a diag. is attended with difficulties, which is explained by the fact that fused silica and apparently all amorphous-glassy subst. even at the lowest experimental temp. depart considerably from the Deby's T^3 low. The theory therefore indicates the reverse of the conjecture that the sp. ht. decreases to the zero point.

E. Ward Tillotson

117. The annealing of glass. Taffin. *Compt. rend.*, **174**, 36–9(1922).—Adams and Williamson (*Ceram. Abs.*, **1**, 166(1922)) obtained a law for the release of stress in glass. T. from a number of expts. concludes that while this law represents the results accurately enough over certain limits of stress, a more complicated equation is needed for a more extended range. Two forms for such equations are suggested.

E. D. W. (*C. A.*)

PATENTS

118. Glass-working mechanism. Noble W. Hartman. U. S. 1,408,000, Feb. 28, 1922. A glass-blowing machine comprising a stationary frame, a non-traveling mold mounted thereon, a blow-pipe, means for rotating the blow-pipe about its longitudinal axis and for swinging it from the mold into a glass pot to gather a charge of glass and then back to the mold, means for marvering the charge during its return to the mold, means for admitting air to the blow-pipe while in operative position with respect to the mold and means for removing the blown article from the blow-pipe during its movement toward the glass pot, the aforesaid means comprising means for causing the aforestated operns. to be automatic and to follow a predetermined sequence, and a single means for supporting the blow-pipe and maintaining it in substantially the same vertical plane during all of the opern. C. M. S., Jr.

119. Glass. Eugene C. Sullivan and William Chittenden Taylor. U. S. 1,408,145, Feb. 28, 1922. Cf. *Ceram. Abs.*, **1**, 82(1922). A glass contg. over 70% silica, over 20% soda and oxides of bivalent elements of the second group of the periodic system, the mol. percentage of the oxides of bivalent elements totaling 7 and less than 12 and also contg. over 1% of alumina. C. M. S., Jr.

120. Initial-puff mechanism for glass-blowing machines. Jacob Weisenberger. U. S. 1,410,857, March 28, 1922. In a device of this kind, the combination of a blow-pipe frame, a cam movable in respect to the frame, a fixed cam plate, a spring actuated air pump for injecting an air puff into a gather of glass carried on the end of a blow-pipe in the frame, means actuated by the movement of the frame for cocking the pump, a trigger mechanism for releasing the pump, a rock-shaft mounted on the cam plate and having a laterally extending arm in engagement with the trigger releasing mechanism, and means for actuating the rock-shaft by the movement of the cam in respect to the blow-pipe frame. C. M. S., Jr.

121. Glass. William Chittenden Taylor. U. S. 1,411,133, March 28, 1922. A glass opaque to the visible light in plates 6 mm. in thickness, and containing manganese dioxide and chromium sesqui-oxide. C. M. S., Jr.

122. Glass. William Chittenden Taylor. U. S. 1,411,134, March 28, 1922. The process of intensifying the color action due to manganese-dioxide by adding to the glass an oxygen compd. of chromium. C. M. S., Jr.

123. Glass-treating fabric and emulsion. ALBERT L. CLAPP. U. S. 1,411,409, April 4, 1922. A wiper for glass comprising a sheet of fibrous material impregnated with an emulsion of kerosene, glycerine and soap. C. M. S., JR.

124. Glass cutter. JOHN R. SCOTT. U. S. 1,411,524, April 4, 1922. In a glass cutter for severing glass cylinders a frame, the edges of the frame having a curvature substantially the same as that of the glass cylinder to be cut, a glass cutter pivotally mounted on the frame and having cutting point, means for producing a substantially constant pressure of the glass cutting point, and means for maintaining a constant direction of pressure relative to the portion of the surface of the glass cylinder against which the point is pressed. C. M. S., JR.

125. Metallizing pottery and glass. Q. MARINO. Brit. 172,723, Sept. 11, 1920. The glaze is removed or the surface roughened by chem. or mechanical means, a silver coating is formed by a chem. process and finally plated with a metal or alloy by electrolysis. The silvering process consists in applying a soln. of $AgNO_3$ in alc., or alc. and ether, allowing the solvent to evap., applying a soln. of formic acid or of formate of Na, K, or NH_4, brushing the surface with a fine wire brush, dipping the article in warm soln. (*C. A.*)

126. Glass manufacture; crucibles, etc. NAAMLOOZE VENNOOTSCHAP. PHILIPS' GLOEILAMPENFABRIEKEN. Brit. 172,610, Nov. 9, 1921. App. for handling or working molten glass is made of a metal or alloy having a high m. p., not evolving gas when heated and forming an adherent and insol. coating of oxide which protects it from attack by the molten glass. Alloys of Cr or Al with Fe, Co, and Ni are mentioned. An alloy of 60% Fe with 40% Cr in particular is suggested. (*C. A.*)

Cement, Lime and Plaster

127. The variation with the temperature of the thermal conductivity of cast iron. E. E. HALL. *Phys. Rev.*, **19**, 237–40(1922).—Results on Fe contg. 3.5% C 2.2% Si and 0.64% Mn indicate that the cond. at 542° is between 2 and 3 times its value at 195°. E. J. C. (*C. A.*)

128. Homogeneity and the raw materials of cements. JULES DAUTREBANDE. *Rev. Mat. Constr. Trav. Pub.*, **149**, 25–27(1922).—Foreign materials are added to cements (a) At the time of grinding the cement: (1) *Materials having a chem. action on the cement.* Such substances as $CaSO_4$ and $CaCl_2$ are added with the object of regulating the setting of the cement. These materials form sulfo-aluminates and chloro-aluminates of lime respectively. (2) *Materials having only a physical action on cement.* These are inert materials as blast fur. slags put in to modify the qualities of the cement. The result is to slow up the setting, to diminish somewhat the tensile strength and to diminish the sp. gr. of the cement. (b) At the time of mixing the cement for use. (1) Sodium carbonate accelerates the setting. (2) Materials to make the mortar of the cement impermeable—such as finely divided calcined clay or slaked lime. Methods for detecting foreign materials in cements. (1) *Boiling water test.* The presence of slag is shown by the blue-green color developed on a test piece when held in boiling water, due to iron sulphide in the slag. Sulfur in cement is usually there as the sulfate, which does not give a coloration. (2) *Microscopic examn.* Slag particles may easily be distinguished by their blue tinge. (3) *Flotation in methylene iodide mixture.* A mixture of benzene and methylene iodide having a density of 2.93 is prepared—the cement having a density of about 3.1 settles, while foreign subs. as sand, siliceous materials, limestones, chalk and slag will float. (4) *Chemical analysis.* A sample of cement is screened by a 200 mesh screen, and the finer material is further separated by elutriation. The chem. analyses of the finest and coarsest divisions will show greater differences in compn. than would result from screenings of a sample of pure cement. LOUIS NAVIAS

129. **Lighting up a modern vertical cement kiln.** C. Tsountas. *Rev. Mat. Constr. Trav. Pub.*, **151**, 70–1(1922).—After an inspection of the mech. parts, to make sure that they are functioning properly, a new kiln is filled in with wood on the grate 1 m. high, and then burned so as to dry out the masonry thoroughly. Large clinkers (about 12–13 cms. in diam.) or waste brick are then fed in thru the mouth of the kiln on to the grate, by means of a wicker basket suspended by its handles by two ropes. Much damage can be done to the refractory lining, if clinkers are just dropped in. The kiln is filled up to within 3 m. below the mouth of the kiln. The clinkers are then levelled off and green brick are lined up in layers against the refractory lining on their narrow and longer sides, one deep. On the clinkers, straw and oiled cotton-waste to a depth of about 50 cms. are filled, then kindling wood for a depth of about 70 cms. Four wooden conduits, 20 cms. × 20 cms. × 3 meters long, are then stuck into the kindling wood in a vertical position. Around the conduits a layer of coke is put, making it thicker at the periphery than at the center. On the coke, a section of green brick is laid in criss-cross manner, so as to leave plenty of air space for combustion. Alternate sections of coke and green brick are laid down until the kiln is full, not forgetting the continuous green brick lining that is being simultaneously set up against the kiln lining proper. The wts. of successive beds of coke decrease, (240–220–200 to 100 kgs.), as the number of brick in a section increase (80–100–120 to 200). Kerosene is then poured down the conduits, and each one fired at the bottom with a lighted fagot. The tops of the conduits are then covered with brick, and the fuel allowed to burn slowly. As the wood burns the material packs and the kiln is continuously kept full by supplying the green brick lining and filler. In the course of 18–20 hrs. the flame will have mounted to the mouth whereupon the grate is gotten ready to draw the kiln, which is then ready for regular service. Louis Navias

130. **Aging of ground clinker.** Le Guen. *Rev. Mat. Constr. Trav. Pub.*, **151**, 76(1922).—Clinker sept. from lime by bolting, is ground in ball mills to 60 mesh, then stored for aging. The grinding cuts down the aging period to about $^1/_5$ the time usually necessary for the unground clinker. A more homogeneous product is also insured. Louis Navias

131. **Hydraulic lime plant at Montebourg, (Manche) France.** Anon. *Rev. Mat. Constr. Trav. Pub.*, **150**, 55–57(1922).—General description of plant and product, with schematic plan of operns. Louis Navias

132. **Artificial Portland cement plant at Montebourg (Manche), France.** Anon. *Rev. Mat. Constr. Trav. Pub.*, **148**, 4–5, **149**, 27–30, **150**, 51–55(1922).—Description of the lime and clay quarries, prepn. of materials, grinding, burning, storing, labs., properties and uses of their cement, together with plans and photographs of the plant. Louis Navias

133. **The theory and practice of stone-wood (magnesia cement or "composition") floorings.** A. Stettbacher. *Schweiz. Chem. Ztg.*, **1921**, 113–7.—The use of this material is increasing but there are occasional failures through improper technic in prepn. or application or exposure. For the properties of magnesia cements see "Magnesia Cement Plastics" *Schweiz Chem. Ztg.*, **1919**, 198–201 and "Composition Flooring" by H. M. Hooker, *Eng. Soc. Western Penn.*, **29**, 305–338, 418–44(1913).—MgO, $MgCl_2$ consists of MgO 0.423, and $MgCl_2$ 1 pt. In practice, however, the standard formula of the associated German mfrs. is 2.40–2.70 pts. of MgO by wt. for 1 pt. $MgCl_2$. Fillers are also used. If the MgO is less than 2.40 the hygroscopic properties of $MgCl_2$ interfere. Ordinary compn. flooring contains (excluding mineral and color addns.) 6 pts. by wt. of burnt magnesite, 5 of cryst. $MgCl_2$ (2.30 anhydr.), and 2 of wood meal. A table is given of corrections if magnesite of less than 100% is used. $MgCl_2$ solns. with sp. gr. from 1.152 to 1.242, contg. 42 to 64% of cryst. $MgCl_2$ are used. A table shows sp.

gr. and anhyd. $MgCl_2$ content. $MgCl_2 \cdot 6H_2O$ contains 46.9% $MgCl_2$. Enough $MgCl_2$ soln. is used to make a stiff paste. Arbitrary grades, *e. g.*, 15 and 18 are used for solns. of 1.152 and 1.184, resp. The corresponding vol. in l. per 5 kg. of cryst. $MgCl_2$ is stated. Analyses of compn. flooring always show some free $MgCl_2$ but a little does no harm. Two analyses show: moisture 4.46–4.01%, wood meal (ash and water-free) 11.50–15.52%, silicates 4.68–4.80%, Fe_2O_3 and Al_2O_3 2.02–2.41%, $CaSO_4$ 1.95–1.66%, $MgCO_3$ 13.02–11.84%, MgO (present as hydroxide and oxychloride) 20.40–17.35%, $MgCl_2$ (H_2O-free) 10.21–10.88% (combined 7.18–7.29%), combined water and org. matter 20.17–19.98%. The ratios of $MgCl_2$ (total) to MgO in all forms in these two cases are 1:3 and 1:25 as compared with the standard ratios of 1:2.4 to 2.7. Some of the MgO changes to useless $MgCO_3$ on standing and some of the $MgCl_2$ remains uncombined. It is doubtful whether the method of detg. this is accurate. It is evident that close technical supervision of compn. flooring is vital. Grecian magnesite is used.

JAS. O. HANDY (*C. A.*)

134. Iron blast furnace slags and their use as building material. RICHARD GRÜN. *Z. angew. Chem.*, **34**, Aufsatzteil, 101–2(1921).—These slags consist of CaO, SiO_2 and Al_2O_3 with small amts. of MnO, MgO and FeO. If unusually high in CaO they are less viscous. The usual uses for granulated and lump slag are mentioned and coal mine filling is suggested. Slag sand mixed with $Ca(OH_2)$ makes a good mortar. Slag with soda and sand adns. should make good glass. Cement manuf. is the rational use for slag. Its normal av. compn. requires only slight modification by CaO addn. This cannot be readily done because of the large heat requirement. G. has used with success an elec. furnace for making CaO addns. Passow has proved that for cement making, slags must have the phys. structure produced by rapid cooling. Otherwise they will not set even if of correct chem. compn. It is necessary also to have as accelerator for the finely ground slag a quantity of portland cement clinker equal to at least $^1/_6$ of the slag. Iron portland cement contains approx. 2 parts portland cement to 1 part slag. Slag lime bricks are made as sand lime bricks are made. They are best hardened by exposure to the exhaust from gas-engines. A porous brick is made by pressing and steaming a mixt. of lime and fine slag with granulated slag.

J. O. H. (*C. A.*)

135. Report on heat insulators. ANON. H. M. Stationery Office, Kingsway, London, W. C., *Special Rept.*, No. 5(1922); *Analyst*, **47**, 119–22.—An abstract. Special app. was devised for the measurement of thermal cond. in abs. measure. Data obtained indicate practically the same thermal cond. for cork, slag wool, charcoal and wood fibers, when of good quality and dry (0.00011 g. cal. per sec. per cm. per l.). Different brands of cork, etc., of good quality show but little differences in their efficiencies as insulators. Tests indicate that a considerable decrease in the insulating efficiency may take place in use. Heat transmission is complicated in the case of coarse granular materials by the circulation of convection currents. Rubber expanded by gas into a highly cellular state has a cond. of 0.000085 which is lower than that of cork and only $1^1/_2$ times that of still air. The original describes the method and app. used for detg. the sp. heats of the materials.

W. H. BOYNTON (*C. A.*)

136. Crystallization and transposition phenomena in the hardening of cement. DR. SCHOTT. *Zement*, **10**, 294–5, 306–8, 328–32(1921); *Chimie & industrie*, **7**, 322; cf. *Ceram. Abs.*, **1**, 91(1922).—On examg. the fracture of cement, crystals are apparent with a magnifying glass, or even with the naked eye when the light strikes properly; but they are too small to be sepd. and analyzed. S. used the following method for obtaining larger crystals: Pour a cement mortar of ordinary consistency on a glass plate covered with a moist sheet of blotting paper and press with a similar glass plate placed on top of the cement. When the cement has set, remove the glass plates and blotting paper, cut in-

to disks, perforate and lay on a wire screen free from rust and provided with a wooden rim, place in a cylindrical glass jar of such dimensions that a space of 1–2 mm. is left between the edge of the disks and the glass, fill the jar with water, and stopper. After a considerable length of time the disks coalesce. First of all colloidal matter, consisting of Ca $(OH)_2$, seps. from the mass, followed after some time by an intense production of very thin foliated crystals of each disk. In 6 yrs. crystals of 0.5 cm. face were obtained. They were hexagonal, negative, and uniaxial; their chem. compn. was H_2O 21.95, SiO_2 2.10, Al_2O_3 0.85, CaO 75.45%, corresponding to $CaO.H_2O$ (CaO 75.67, H_2O 24.33). This confirms the hypothesis that the setting of cement is due to the crystn. of $Ca(OH)_2$. The limit of the CaO content is that which makes the cement expand. S. then investigated the effect of burning, of clinkering temp., and of the various materials contained in the cement. A. P.-C. (*C. A.*)

137. **Advantages of hydrated lime in paving concrete.** T. B. Shertzer. *Can. Eng.*, **42**, 111–112(1922).—The advantages claimed are the prevention of segregation and consequent increase in uniformity; lubrication of the concrete which makes placing and finishing easier; formation of an insol. water-tight skin on the surface; promotion of a more compact arrangement of the other ingredients and efficiency as a water-tightener. J. C. Witt (*C. A.*)

PATENTS

138. **Cementing or luting composition.** K. O. Dufva. U. S. 1,407,194, Feb. 21, 1922. A cementing compn. adapted for use on steam pipe joints is formed of powdered corundum and paint, rosin and shellac varnish. (*C. A.*)

139. **Separating composition for plaster casts.** J. B. Jones. U. S. 1,406,651, Feb. 14, 1922. Shellac dissolved in an aq. soln. of borax. (*C. A.*)

140. **Plastic composition and process of making the same.** George M. Formby. U. S. 1,409,939, March 21, 1922. The herein described new article of manuf. containing a calcium oxychloride that has been heated with lime in the presence of water, and the compd. thus produced mixed with plaster of Paris. C. M. S., Jr.

141. **Plastic cement mixture.** W. E. W. Richards. U. S. 1,408,401, Feb. 28, 1922. A mixt. of powd. clay, ground cement and fiber with H_2O is molded under pressure to form *elec. insulators or other articles.* (*C. A.*)

142. **Dental cement.** S. Schiff. (*Jour. Amer. Ceram. Soc.*, **4**, 1013(1921)). U. S. 1,408,960, Mar. 7, 1922. An emulsoid acetogel of silicic acid is added to a mixt. formed of pulverulent Al K silicate and H_3PO_4. (*C. A.*)

CERAMIC ABSTRACTS

Compiled by the

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[1] The abbreviation (*C. A.*) at the end of an abstract indicates that the abstract was secured from the Editor of *Chemical Abstracts* by coöperative agreement.

General and Miscellaneous

1. **Canadian ceramic specialists for Canada.** Editorial. *Can. Min. Jour.*, **43**, 282(1922).—A movement has originated with the Canadian Clay Products Association and was discussed at the Toronto meeting in May, dealing with the establishment, at Toronto University, of a course in ceram. which would give to Canada ceram. engineers who had received both tech. training and practical experience at home. The ceram. industry is at present in an embryonic state but the raw materials for this industry, feldspar, silica rock, and china clay are plentiful, and steady progress is being made. This movement is a step in the right direction towards establishing an important new industry. O. P. R. O.

2. **Bentonite.** Keele. Mines Branch, Canada Department of Mines. *Summary Report*, **160** (1918).—The variety of clay known as "bentonite" occurs in many localities in Wyoming but was first discovered in Canada in 1911 by Keele in an excavation in the town of Camrose, Alberta. Later discoveries of the clay have been made in the Edmonton formation of the Red Deer river and in the Nicola Valley, B. C. Description: When freshly exposed it varies from a light yellow to a light olive green with a waxy lustre. It is exceedingly fine-grained and has a scaly feeling when wet. It has unusual absorbent qualities being capable of taking up three times its weight in water, when it swells and becomes a jelly-like mass. Although refractory, it contains too high a percentage of fluxing impurities to be a fire clay. It cracks badly in drying. Chemical analyses of Camrose, Alberta, bentonite compared with that of Crook County, Wyoming:

	Crook County, Wyoming	Camrose, Alberta
Silica	61.08	69.14
Alumina	17.12	14.50
Iron	3.17	2.56
Lime	2.69	2.45
Magnesia	1.82	1.14
Potash	....	.19
Soda	.20	1.25
Sulphur trioxide	.80	1.70
Loss on ignition	12.10	7.71

Uses: Its chief use has been to give body and weight in the manufacture of paper. I has also been used as an adulterant of cheap candy and in the manufacture of antiphlogistine. Recently its use has been suggested as a sizing for yarns on account of the large proportion of colloidal silicate of alumina which it contains. . . .Further Investigation: Consequent upon inquiries directed to the Department of Mines by the Imperial Mineral Resources Bureau regarding possible sources of bentonite in Canada the localities mentioned above were again visited and work is now being done in the Mines Branch laboratory which will enable definite conclusions to be drawn regarding the suitability of Canadian bentonites for industrial purposes. O. P. R. O.

3. **Clay and clay products industry of Canada.** Anon. *Agric. and Indus. Progress in Canada* (C. P. R.), **3**, 2155(1921).—The clay industry in Canada is apparently on a healthy basis as the total value of products are as follows: 1920—$10,523,271; 1919—$7,906,366. In 1920 this was made up of common brick $4,868,958; pressed brick $1,756,760; fire-proofing $591,216; hollow building blocks $284,163; kaolin $15,022; terra cotta $120,875; pottery $207,410; sewer pipe $1,549,090; drain tile $619,442; other products $517,335. Canada's imports in 1920 were as follows: china clay $242,441; fire clay $276,139; pipe clay $2,442; other clays $151,760. Her total

imports of clay products in 1920 amounted to $10,781,592, principally from Great Britain and the U. S. Her total exports amounted to $323,989, of which $4,678 went to the United Kingdom, $240,128 to the U. S., and the balance to other countries. The principal centres of the clay mfg. industry are at St. John, New Brunswick; St. Johns, Quebec; and Medicine Hat, Alberta. O. P. R. O.

4. Building materials industry in Czechoslovakia. ANON. *Jour. Royal Soc. Arts* (London), **70,** 489–9(1922).—The building materials industry in Czechoslovakia occupies a very prominent position. This importance is due to the rich deposits of kaolin, clay and limestone. The brick industry is one of the oldest in the country; the number of workmen employed is 80,000; annual output 2,000,000,000 bricks and 200,000,000 tiles. Czechoslovakia contains 30 large and several hundred smaller kaolin mines and the output amts. annually to more than 20,000 wagons, of which 80% is exported. Porcelain is produced in 70 factories; the annual output exceeds 3,000 wagons, 70% of which is exported. The output of the magnesite mines is nearly all exported. 40,000 wagons of fire-proof bricks are exported. The pottery annual output amts. to 2,000 wagons, largely for export trade. There are 60 factories producing an annual total of 5,500 wagons of stone and chem. piping, largely for export trade. Flagstone industry is carried on in 12 factories, annual capacity 9,000 wagons: Portland cement, 12 factories, annual capacity 50,000, largely exported. Limestone, annual production 90,000 wagons, 10% exported. Among the natural building-stones there are numerous types of granite. Sandstone rocks are found and red, grey, and white marble are in abundance, annual export about 1,800 wagons. Building materials industry forms a group of the Federation Industrialists. There are special schools for pottery, brickmaking and stone-cutting, respectively, and the problems affecting these industries are studied from a scientific and a practical standpoint. O. P. R. O.

5. Experimental cottages. Farm colony at Amesbury. ANON. *Jour. Royal Soc. of Arts,* **70,** 508(1922).—Thirty-three experimental cottages, to test various methods of building with local materials, have been erected by the Ministry of Agriculture with the coöperation of the Dept. of Scientific and Industrial Research, London. Without expressing an opinion of the success or failure of the experimental features, the Department considers a description of the work may be of general interest and a report is now published which may be obtained from H. M. Stationery Office, London. The external walls of the several cottages are of brick, concrete, chalk and cement, rammed chalk, and straw and chalk pisé, respectively. Various experimental designs of floors, roofs, stairs, fittings and heating appliances have been used. O. P. R. O.

6. A Russian Fire Clay Concern. ANON. *Raw Materials Rev.,* **1,** 58(1922).—The Borovitch fire clay establishment is able to make a good rept. on its production of fire clay and other goods, which has improved monthly since last autumn, reaching its highest point in March, 1922, when its presses turned out 1,250,000 bricks against a million in January and February. The work per man per day has also improved, and is even better than pre-war. But for want of fuel the quantity fired has had to be reduced, so that some presses recently started will have to be stopped. The number of workers and other hands engaged at the factory is 1,433. O. P. R. O.

7. Some properties of commercial silicate of soda. JAMES G. VAIL. *Amer. Chem. Soc.,* (Sept. 2–6, 1919).—A discussion of the properties of commercial silicate of soda and its phys. characteristics. A definite compd. of the formula Na_2SiO_3 is easily prepd. in cryst. form from solns. containing sodium hydroxide and commercial sodium silicate. It crysts. with 9 mols. of water. It melts in its water of crystn. at about 40° C. It is rapidly decomposed by the carbon dioxide of the air. This product has no commercial significance. All the forms of sodium silicate in commercial use contain more silica than is indicated by the formula Na_2SiO_3, one grade having about 4 times

this amount. The ratio between sodium oxide, Na_2O, and silica, SiO_2, may be varied between 1 to 4 and 2 to 3. Products more alk. than the latter ratio are not made, on account of their tendency to form cryst. masses. The solns. of these different silicates vary largely in their characteristics. To take the two extremes; that with a ratio of 1 to 4, as above, may be concd. to about 37° Bé, which corresponds to about 34% total solids. In contrast to this type, a silicate with a ratio of 2 to 3 is thinly fluid at 37° Bé, and may be concd. to approx. 69° Bé, or about 62.5% total solids. Between these two extremes any intermediate grade can be produced; thus a considerable range of characteristics which are of importance in the adhesive uses of silicate of soda can be secured. As the propn. of alkali increases, the possible concn. increases, and there are in regular use different silicate solns. of 37°, 40°, 42°, 47°, 50°, 52°, 60° and 69°, each adapted especially for some commercial use. The colloidal nature of silicate solns. is indicated by b. p. but little higher than the b. p. of water. This is true even in the case of the 69° soln. which contains more than 62% of solids. The f. p. also are but slightly depressed from that of water. The ordinary 40 silicate freezes at about —3° C. When such a soln. is slightly warmed, the crys. tend to float. Solns. of above 60° Bé in concn. do not lose their transparency on freezing, but become progressively harder and finally brittle. Silicate of soda is pptd. by most salts of the heavy metals, and the ppts. are believed to contain free silicic acid along with metallic silicates. Pptn. is also effected by various liquids which tend to dehydrate the silicate soln. For instance, alc., glycerin, salt brine, and strong ammonia solns. will ppt. concd. solns. of sodium silicate. Such ppts. may be redissolved, but the second soln. has somewhat different characteristics from the original silicate soln. notably in respect to viscosity. The viscosities of solns. of silicate of soda are of interest in connection with many of its uses. The forms rich in silica rise slowly in viscosity until the condition of jelly is approached, when they rise very sharply. This is true whether the rise in viscosity is due to decrease of alkalinity, decrease of temp., or increase in concn. To prep. a silicate adapted as a quicksetting adhesive, use is made of this fact. A change from a liquid to a solid condition may occur with the loss of as little as 10% of moisture, this amt. being very quickly absorbed into a layer of paper board when the silicate is thinly spread on its surface. If suddenly exposed to a temp. above the b. p. of water, such a soln. will expand into a mass of permanent bubbles of beautiful white appearance and apparent sp. gr. as low as 0.01. Such a product is an excellent thermal insulator. Silicate of soda is the most convenient source of gels of silicic acid which may be prepd. with either alkaline or acid reaction by neutralizing more or less completely. Any mineral acid can be used for this purpose, and by varying concns. of acid and of silicate soln., gels of a wide variety of physical characteristics can be secured. Strongly acid gels have been used to prevent the splashing of acid from storage batteries. Very hard neutral gels have been used for prepg. material suitable for the adsorption of gases. The tensile strength of silicate of soda mixts. used for acid-proof cements is easily brought up to 1700 lbs. per sq. in. for air-dried briquettes, while the bond produced by baking silicate of soda and clay, as is the practice in the manuf. of abrasive wheels, easily yields a strength above 2000 lbs. per sq. in. F. H. R.

8. **Producer gas plant design.** R. F. Clewell. *Glass Industry*, 2, 283–7(1921); 3, 5–9, 32–6(1922), 11 figs.—Plant design for the manuf. and distribution of raw producer gas is discussed in detail under the following heads: Plant location, plant capacity, selection of equipment, provision for future extension, arrangement and accessibility of equipment for ease of operation and maintenance, and the gas-distributing system. J. B. Patch (*C. A.*)

9. **The importance of clean gas for the producer plant.** F. J. Denk. *Glass Worker*, 41, No. 27, 12, 36–8(1922).—The savings resulting from the use of small gas pipe in-

stead of large brick-lined mains together with repairs and cleaning, etc., of lines and regenerators pay for the cost of producing clean gas which is also more efficiently used in the furnace. J. B. Patch (*C. A.*)

10. Graphical treatment of stack gas analysis and of producer gas analysis. W. Trinks. *Blast Furnace Steel Plant*, **10**, 131–5(1922).—A review of charts introduced by W. Ostwald and developed by Claus and Neussel. (Cf. *Ceram. Abs.*, **1**, 154(1922). C. E. Carlson (*C. A.*)

11. Electrical precipitation. H. J. Bush. *J. Soc. Chem. Ind.*, **41**, 21T–28T(1922); cf. *C. A.*, **15**, 2587.—An interesting review with bibliography and drawings of installations. Elec. pptn. is now in use all over the world. It has been applied to the pptn. of H_2SO_4, precious metal dust, potash, particles from blast furnaces and pyrite burners, lead smelter fumes, tin furnace fumes, alumina, calcining furnace gases, waste gases from evaporators of sulfate liquors from cellulose works, gases from coal briquetting furnaces, copper converters, McDougall roasters and to the purification of and removal of bacteria from air. D. MacRae (*C. A.*)

12. Modern tunnel-kilns. A. E. Buch. *Kalk Gips- u. Schamotte Ztg.*, **28** (June 21, 1921); *Chimie et industrie*, **7**, 518(1922).—A discussion of the merits and advantages of modern tunnel kilns in the ceramic industry, together with a description of the Buch, Möller and Pfeifer, and Dressler systems. A. P.-C. (*C. A.*)

PATENTS

13. Zinc oxide. F. C. W. Timm. U. S. 1,409,318, Mar. 14. Zn-bearing slags or the like are placed on a layer of dezincing material such as C, lime and Fe compds. and hot combustion gases are passed through the charge and gases laden with ZnO are withdrawn from below. (*C. A.*)

14. Phonograph needles of shale or clay. M. T. Straight. U. S. 1,409,498, Mar. 14. Needles of shale or clay are heated to near the m. p. and then gradually cooled. (*C. A.*)

Apparatus and Instruments

15. The new radiation pyrometer of Hase. Anon. *Gieserei Ztg.*, **9**, 31–2(1922).—An illustrated description of an instrument for foundry practice. It is a compromise between scientifically precise app. like the Wanner pyrometer and the comparatively crude pyroscopes so generally used. It is a modification of the Féry pyrometer, in which the sensitivity of the radiation receiver is greatly increased. It is in the form of a telescope weighing 2.5 kg. and can be used by hand. The temp. can be read by direct observation, and the indicator is so adjusted that temp. variations in short periods can be detected. From 1 m. or greater, the reading is independent of the distance. The temp. ranges are 700–1400°, and 1200–2000°, and at 1000° an error not over 10–15° is practicable. C. C. Davis (*C. A.*)

16. Improvements in measuring apparatus for gases, vapors, liquids and granular substances. F. M. Bayer. *Chem. App.*, **8**, 59–61, 67–9, 88–90, 94–6, 161–3, 170–3, 179–81(1921); **9**, 22–4, 52–4(1922).—A review of Ger. patents, with 60 cuts. J. H. M. (*C. A.*)

17. Conveying machinery in the chemical industry. Geo. F. Zimmer. *Chem. Age* (London), **6**, 230–33(1922); cf. *C. A.*, **15**, 1967.—This article covers bucket elevators and band and reciprocating conveyors. It is suggested that stainless steel and high Si irons be used for chem. plant elevators, etc. A. E. Marshall (*C. A.*)

18. Disappearing filament pyrometer. Anon. *Engineering*, **113**, 501(1922).—This paper describes an optical pyrometer of the disappearing filament type in which

the optical system, lamp, rheostat and meter are in one compact unit. In order to utilize the full scale of the meter the latter is connected in a special way. The lamp is placed in one arm of a Wheatstone bridge, the other three arms being manganin resistances. By this device the scale of the meter may be so calibrated as to begin with the lowest temp. which the instrument will read, thus eliminating the useless portion of the scale. The range is from 700 to 1200° with current flowing in one direction and from 1200 to 1510° when the direction is reversed. Absorption screens are used for higher temps., and the accuracy is about 5°. DONALD E. SHARP (*C. A.*)

PATENTS

19. Apparatus for drying and medicating air. C. DOBBS and A. E. PAINTER. U. S. 1,409,364, Mar. 14, 1922. (*C. A.*)

20. Detachable puddle rod and blade. L. W. JONES. Can. 217,403, Mar. 28, 1922.—A melting pot has a tubular shaft arranged for operation therein and arms or blades, which are substantially triangular in cross section and have inclined openings therethrough, carried by the lower portion of the shaft. (*C. A.*)

21. Separating solid materials. S. NETTLETON. Brit. 174,739, Nov. 2, 1920. For sep. solids, *e. g.*, sepg. stone, shale, etc., from coal, the mixt. is delivered at a suitable velocity on to one or more flat horizontal rotating disks upon which the constituents are deflected to different degrees according to their frictional coeffs. The mixt. may be delivered by inclined shoots to the disks. A suitable construction is specified. (*C. A.*)

Chemistry, Physics and Geology

22. Physical chemistry and ceramics. EDWARD W. WASHBURN. *Jr. Franklin Inst.*, **193**, 6, 749(1922).—The application of phys. chem. to the soln. of ceram. problems is discussed under the fol. heads. (1) Colloid chem., (2) heterogeneous equilibrium at high temps., (3) properties of silicate solns. at high temps. including d., elec., cond., viscosity and surface tension, (4) standard methods of testing ceram. materials. Data on the viscosity and surface tension of the system Na_2O-SiO_2-CaO is given. R. J. M.

23. Stratification of clay suspensions and its use in the determination of the size of clay particles. ERNST UNGERER. *Kolloidchem. Beihefte*, **14**, 3–5, 63–96(1921) (R. RIEKE). Suspensions of known substances such as ultramarine blue are made, different fractions obtained by centrifuging and the particles in each strata counted, weighed and measured as described in the article. By this means data of the following nature is obtained:

TABLE 1

Suspension	Time of centrifuging in min.	Weight of one particle	Diameter of one particle
Ultramarine blue			
number 8	2 ½	$1.79 \cdot 10^{-11}$g	$2.08 \pm 0.038\mu$
"	3 ½	$1.34 \cdot 10^{-11}$g	$1.76 \pm 0.041\mu$
"	4 ½	$0.80 \cdot 10^{-11}$g	$1.23 \pm 0.004\mu$
"	4 ½+	$0.30 \cdot 10^{-11}$g	$0.86 \pm 0.009\mu$

The size of the particles was also determined by means of Stokes' Formula from which the following relation is obtained—

$$r = \sqrt{\frac{9}{2} \cdot \frac{n}{D-d.g}} \cdot \sqrt{v}$$

when

r = radius of particle
n = viscosity of fluid
D = density of fluid
d = density of particle
v = rate of fall of particle

This formula gives results which check very closely with those obtained by direct measurement as described. A clay suspension was then studied and following data obtained:

TABLE II

Time of standing	Height in cm. of				
	1 layer	2 layer	3 layer	4 layer	5 layer
96 hours	...	1.8	2.7	3.6	7.9
144 "	1.2	2.1	3.6	5.4	12.2
192 "	1.4	2.6	5.0	7.8	16.7
240 "	1.9	3.8	6.5	10.7	20.3
Size of particle (calculated)	0.151μ	0.213μ	0.278μ	0.344μ	0.497μ
Size of particle (measured after 240 hours)	...	0.200μ	0.297μ	0.332μ	0.527μ

The writer also demonstrated the adaptability of Stokes' Formula to the study of soil suspensions and of emulsions. Several conclusions covering the characteristics of the strata and the conditions under which they will form are added. R. F. G.

24. A new source of soapstone in Ontario. H. S. SPENCE. *Memorandum No. 4, Mines Branch,* Dept. of Mines, Canada (April, 1922).—An extensive deposit occurs at Wabigoon Station on the main line of C. P. R. near Dryden, Ontario, and is distant only 500 yards from the railroad. It is well situated for working but no development work has yet been conducted. Tests of the stone for crushing strength, transverse strength, corrosion, absorption, fusion temperature, as well as chemical-analyses, have been made in the Mines Branch laboratory and show the deposit to be a very high grade. In appearance and composition (as shown by analyses) it is very similar to the so-called "Alberne Stone" quarried extensively in Virginia. The use which suggests itself most strongly for the stone of this deposit is for bricks for lining the smelting furnaces of sulfate pulp mills, which require a refractory material which is structurally strong and does not crack under heat. The dozen or more of such mills in Canada would benefit greatly if the Wabigoon stone proves profitable for working, as at present all such material has to be imported. The report concludes with the words, "This deposit is the most promising from an economic standpoint of any of the soapstone occurrences seen in Canada." O. P. R. O.

25. Fire brick manufactured at Clayburn, British Columbia. WILLIAM FLEET ROBERTSON. British Columbia. *Annual report of the Minister of Mines,* N 28 (1921).

—A bed of excellent fire clay, occurring in bedded rocks of the Eocene age, is found in commercial quantities near Clayburn. Shales, sandstone, and conglomerates, all but little consolidated, make up this sedimentary series. Fire brick is the principal manufactured article produced by the Clayburn Co. Ltd., but in addition common brick, paving brick, tile, drain-pipe and prepared fire clay are made. Associated with these rocks is a bed of lignite which is sufficiently good to be used for firing the boilers of the fire-brick plant. O. P. R. O.

26. Talc in Canada. M. E. Wilson. *Can. Min. Jour.*, **43**, 356(1922).—Deposits of talc or soapstone occur throughout Canada in Nova Scotia, British Columbia, Ontario and Quebec, but most of these, so far as development work has shown, are either limited in extent or impure, so that the only extensive known deposits of high grade talc in Canada are those occurring in Ontario. The rocks with which these deposits are associated consist almost entirely of dolomite, quartzite and interlaminated quartz and dolomite, but batholithic masses of granite occur nearby. O. P. R. O.

27. Talc in New Zealand. P. G. Morgan. *New Zealand Jour. of Sci. and Tech.*, **2**, 112(1919).—There are numerous occurrences of talc (also called soapstone, steatite, French chalk, or potstone) in N. Z. Some of these appear to be of good quality. At the present time colored French chalk for tailors' use is being sold in N. Z. at something like 10s. per pound, and the manufacture of crayons, etc., from local talc appears to be a feasible undertaking for any person acquainted with the technical details. Crystalized talc of great purity is found in small pockets here and there in association with the talc and serpentine rocks of north Westland; green talc schists are also common; but owing to the difficulty of access none of these talcose rocks have economic value at the present time. O. P. R. O.

28. Clay and fullers' earth in New Zealand. P. G. Morgan. *New Zealand Jour. of Sci. and Tech.*, **2**, 119(1919).—On account of an urgent demand for fullers' earth suitable for use as a clarifying medium, the Geological Survey has given further attention to the subject and largely through inquiries and investigations made by the Survey and the Dominion Laboratory, it is believed that at least three satisfactory sources of fullers' earth have been discovered—one at Glen Massey, Waikato district; another at Croydon, near Gore; and the third at Hokonui, Southland. In addn. to these many other clays have been found to possess considerable clarifying power—some exceptionally good quality for use as fire clay and some valuable for porcelain. O. P. R. O.

29. Graphite in New Zealand. P. G. Morgan. *New Zealand Jour. of Sci. and Tech.*, **2**, 207(1919).—The numerous records of graphite occurrences in New Zealand indicate a probability of workable deposits being found if search is made. Three kinds of natural graphite—namely cryst., flake, and amorphous—are mentioned in market repts. Cryst. graphite is the nearly pure material, found in pockets and lenses, which can be put on the market without any preliminary treatment. At the present time by far the largest supplies come from Ceylon. Flake graphite is the same material as cryst. graphite, but has been produced from less pure deposits by some process of concentration. Amorphous graphite is in part not true graphite at all, but altered coaly material which has lost all its hydrocarbon, though it has not undergone the mol. change required to reach the stage of graphite as known to the mineralogist. Such material has no heat-resisting power, nor is it suitable for the manufacture of lead-pencils, etc. A bibliography on graphite is given. O. P. R. O.

30. Polo halite in Italy. Anon. *Raw Materials Rev.*, **1**, 43(1922).—A mineral of great utility to the glass industry and for soap-making has been found at Calascibetta in the valley of the Morelle River at Sicily. It has been named "Polohalite." A dip has disclosed the following formation:—Saline marle containing gypsum, chloride

of sodium 2 m., sulfates of various bases 14 m., sulfate and chloride of sodium 4 m., other sulfates of various bases, marle and gypsum in great masses. It is hoped to exploit these deposits for glass works, and to a certain extent for soap making. O. P. R. O.

31. Bauxite in Italy. Anon. *Raw Materials Rev.*, **1**, 43 (1922). Large deposits of bauxite are known to exist in New Italy, particularly in Istria. It is not equal to the bauxites of Sangiunge or of the Abruzzi which are highly prized as the basis of a large national production of metallic aluminium, oxide of aluminium, and sulfate of aluminium. The Istrian bauxite does not average more than 55% of oxide of aluminium, but the deposits being near to the Austrian and German frontiers, may be exploited for export of this valued raw material to the industrial districts of Germany, which country during the war developed a most important industry in oxide of aluminium and metallic aluminium. The difference of cost of transport from Istria to South Germany as compared with that of French bauxite via Rotterdam shows the possibilities of the export of the Italian material. O. P. R. O.

32. Sicilian sulfate of soda. Anon. *Raw Materials Rev.*, **1**, 43(1922).—Several important sulfate of soda deposits have been identified in Sicily; particularly one at Bompensiere in the province of Caltanissetta, and one near Calascibetta in the same province. The deposit at Bompensiere is principally Glauberite, that is, sulfate of calcium and sulfate of sodium combined. But the constituent of the upper layers is principally pure sulfate of soda, transparent and vitreous. New methods of working have made the exploitation of these fields possible at a profit. Taking advantage of the different solubility of the salts it is proposed to dissolve them in water; the gypsum becoming residuum would crystallize the sulfate of soda. If one crystallization does not suffice, it is proposed to repeat the process until complete purification results. Instead of extracting the mineral and treating it in large shallow basins, thus obtaining the saturated solution, warm water is to be introduced into the mine, and when it is saturated with the salt, it will be pumped up as is done at Stassfurt. In this way advantage is taken of the poorer mineral. With the Glauberite there is also found some chloride of sodium. O. P. R. O.

33. World's graphite production. (1921). Anon. *Can. Min. Jour.*, **43**, 233.—Production in 1921 was less than at any time since 1902. Canada and Ceylon fell greatly behind pre-war tonnages. Dorea held its own. Germany alone forged ahead with an increase of 50 per cent more than 1920. O. P. R. O.

34. Fluorspar in British Columbia. William Fleet Robertson. *B. C. Annual Rept. of the Minister of Mines*, **No. 24**(1921).—The development work done by the Consolidated Mining and Smelting Co. of fluorspar concn. for the last two or three years has been very interesting. The Co. is now equipped with an efficient concg. mill. It produced during the year some 7,500 tons of fluorspar concentrates, carrying 87% calcium fluoride and 6% silica; and having a total value of about $175,000. The mineral is used for making hydrofluoric acid, in lead refineries in Canada and the U. S. O. P. R. O.

35. Dutch bauxite. Anon. *Raw Materials Rev.*, **1**, 58(1922).—Bauxite mines are being worked by an American company at Moengo, in the Dutch colony of Surinam. Bauxite, the ore from which aluminium is extracted, found in Surinam, Dutch East Indies, has an aluminium oxide of 55 per cent. The Bauxite Company owns twenty-two sea and river barges and seven launches, and the Aluminium Line sends its vessels to Surinam to fetch the ore to America, where it is smelted. In Surinam itself the ore is dried only; the aluminium is extracted in the furnaces in America. The quantity of ore at Moengo is estimated at 10,000,000 tons. A good harbor is to be made there in order to ensure quicker shipment of the ore. O. P. R. O.

36. Cobalt oxide in Canada. Charles W. Drury. *Ont. Bureau of Mines Rept.*,

27, Pt. 3, 31(1918).—Previous to 1903, Europe controlled the world's supply of cobalt. Since its discovery in Canada at that time, very little has been mined outside of that country. Canada produces from the cobalt ore a very high grade cobalt oxide, which is much in demand by the ceram. industries of Europe, and does this at about one-half the price that the low and medium cobalt compds. or smelts were sold in Europe ten years ago. In reviewing the metallurgy of cobalt the change is noticeable; in the European refineries ores were treated for the cobalt content alone, while from the ores of Canada, metallic silver, cobalt, nickel and arsenic oxide are recovered. The associated metals are often a source of revenue for the smelters. O. P. R. O.

37. **Potash from feldspar.** Sydney Johnstone. *Imperial Institute Monograph*, (1922).—This monograph deals with the sources of the world's supply of potash and among these the feldspars of Canada attract great attention, for while the problem of extracting potash from feldspar economically has not yet been solved, investigation continues and Canada's abundant supply of this source promises much for the future. A process is now on trial at the works of the National Portland Cement Co., Durham, Ont. O. P. R. O.

38. **The separation of ferric iron and aluminium from calcium by the nitrate method.** Charriou. *Compt. rend.*, **174**, 751–4(1922).—St. Claire Deville proposed the sepn. of Fe and Al from Ca on the basis of the fact that the nitrates of the trivalent metals are decomposed by heat, leaving an insol. oxide whereas the nitrates of alkaline earth metals are less readily decomposed and the oxides are much more sol. in water. A sepn. carried out on this basis is usually unsatisfactory because a little alkaline earth is likely to be held back in the residue of oxides. This entrainment of CaO is found to be very appreciable but is less if the nitrates are decomposed at a fairly low temp. (150°) and if the oxides are subjected to repeated treatments with boiling 5% NH_4NO_3 soln. If the residue contains this substance the entrainment of CaO is prevented but the insol. oxides are so pulverulent that they are likely to run through the filter. The most satisfactory method of working seems to be that of adding a slight excess of NH_4OH before evapg. to dryness. Then, after the ignition, treatment with NH_4NO_3 soln. serves to dissolve out all the Ca. If Al is present, however, the filtration is tedious so that it is advisable to wash the residue twice by decantation, then dissolve it in boiling HNO_3 and ppt. again with NH_4OH. It is difficult to remove all of the oxides from the dish in which the ignition took place. This difficulty may be overcome by weighing the dish at the beginning and end of the process, to find the amt. of adhering oxide, or by dissolving the residue in acid and pptg. by NH_4OH. W. T. H. (*C. A.*)

39. **Specific heat of solids at high temperatures.** M. Born and E. Brody. *Z. Physik*, **6**, 132–9(1921).—A mathematical paper in which are considered the quantum theory of an oscillator system of large amplitude of vibration, and the statistics of the oscillator system. For the at. heat at const. vol. (C_v), the following expression is deduced: $C_v = dU/dT = 3R(1-6\sigma RT)$, where the quantities have their usual significance. From exptl. data it is shown that $C_v = 5.8546 + 0.000649T$.

H. J. C. (*C. A.*)

40. **Weighing by substitution.** C. A. Briggs and E. D. Gordon. Bur. of Standards, *Tech. Paper*, **208**, 177–92(1922).—Sp. directions are given for weighing by substitution, as developed by the Bur. of Standards for the testing of large weights. This paper is written especially for makers of scales and weights.

C. E. Carlson (*C. A.*)

41. **A new occurrence of cristobalite in California.** A. F. Rogers. *J. Geology* **30**, 211–6(1922).—In obsidian from San Bernardino Co. (n = 1.483, ± 0.003), are rod-shaped crystallites in parallel lines, and spherulites 5–25 mm. in diam. The solid

portions of the spherulites consist of orthoclase and cristobalite, in fibrous aggregates which on microscopic examn. prove to be intergrowths. Other minerals identified include tridymite, opal, magnetite and fayalite. The cristobalite was formed at a high temp. and as the temp. became lower, tridymite appeared, and at about the same time fayalite and magnetite. The opal is the only mineral formed by ordinary solns.

W. F. H. (*C. A.*)

42. The representation of igneous rocks in triangular diagrams. Albert Johannsen. *J. Geol.*, **30**, 167–9(1922).—By means of a dot and a line J. plots, without the use of a slide rule or any calcn., the actual % of quartz, orthoclase, plagioclase, and dark minerals, as well as their relative % among the light constituents. W. F. H. (*C. A.*)

43. Sizes of atoms in crystals. R. N. Pease. *J. Am. Chem. Soc.*, **44**, 769–74 (1922).—It is shown that the contribution of an atom to the distance between it and another in a crystal depends on the no. and arrangement of electrons about its positive nucleus, on the type of lattice, at least as this affects the lattice, and, ordinarily, on the magnitude of the charge carried by the atom, and that the particular element is of secondary importance, *for elements whose atoms are of the same rare-gas type.* The inter-at. distances in crystals of the diamond type of lattice have been analyzed from this point of view. H. Jermain Creighton (*C. A.*)

44. The influence of the concentration of colloids on their precipitation by electrolytes. H. B. Weiser and H. O. Nicholas. *J. Phys. Chem.*, **25**, 742–57(1921); cf. *C. A.*, **16**, 1351.—The colloids, hydrous chromic oxide, Prussian blue, hydrous ferric oxide, and arsenious sulfide were used with 1- and 2-, and 3- or 4-valent pptg. ions. The pptn. values of all electrolytes decrease as the concn. of the colloid is lowered in all cases except As_2S_3 with univalent pptg. ions. With As_2S_3 the pptn. value of electrolytes with univalent pptg. ions increases with decreasing concn. of colloid. The 2 opposing tendencies due to dilu., the smaller concn. of colloid which required less pptg. ion to neutralize it, and the greater dispersion which required a greater concn. of pptg. ion to secure collisions, have been assumed to be the principal factors in detg. the relation between concn. and pptn. Another more important factor is the effect of the adsorbability of the oppositely charged ion which may be absorbed and stabilize the colloid. F. E. Brown (*C. A.*)

45. Studies on specific heats. III. M. Padoa. *Gazz. chim. ital.*, **52, I**, 25–9 (1922); cf. *C. A.*, **15**, 1844.—In the preceding paper P. showed with exptl. data that the multiplication and intensification of bonds between atoms in solid polymerized compds. produces a marked diminution of the sp. heat. Reasoning in the same way elements whose sp. heats are markedly lower than required by the law of Dulong and Petit ought to have a considerable no. of valences. In solid solns. of an element abnormal in this respect in an excess of an element normal in its sp. heats, it should be possible to detect an increase in the sp. heat of the abnormal element. Abnormal elements capable of giving solid solns. in normal elements are not numerous. C is sol. in Fe only to the extent of 2% and could not be used. Si, however, forms solid solns. up to 18% Si in Fe. Detns. of the sp. heat of alloys contg. 10.14, 33.6 (FeSi), 50, 75, 85 and 95% Si gave values for the at. heat as follows: 6.42, 6.04, 5.27, 4.83, 4.78, 4.75 and 4.74, resp. The data for FeSi were taken from Schimpff (*Z. anorg. Chem.*, **71**, 257(1910)). The results show that the sp. heat of Si rises in solid solns. as the dilu. increases although an extra high value (6.64) was taken for Fe. "The formation of the solid solns. thus corresponds to a pulverization into free atoms of Si and produces the effect of restoring to them the degree of freedom necessary in order that the energy content proper to the thermal oscillations may rise to the level characteristic of most of the metals." Results equally satisfactory for Se in the system S-Se were obtained. In the system S-Se solid solns. contg. 4, 9, 28.77, 90.35% (rhombic and monoclinic

forms of this mixt.) at. heats for S of 7.03, 6.00, 5.87, 5.50, 5.78, resp., were obtained. Here also the at. heat is max. for the greatest dilu. of S. In Se-Te in which both components are normal the sp. heats were additive, as they should be. E. J. W. (*C. A.*)

46. A simple formula for calculation of the specific heats of solids. H. J. Krase. *J. Am. Chem. Soc.*, **44**, 784–6(1922).—This is an empirical equation for representing the empirically and graphically found values given by Lewis and Gibson (*C. A.*, **12**, 14). The agreement is out 30% or so at very low temps., is good to about 2.5% at the characteristic temp. Θ, the temp. for each substance for which C_v (per gram atom) = 2.96, and to 2 to 4 per mille if T is 1.6 or more times Θ. The equation is: $C_v = 2.91 + 2.89 \tan h\ 2.95 \log T/\Theta$. W. P. White (*C. A.*)

Refractories and Furnaces

47. The composition and micro-structure of clays and their fusibility at high temperatures. Leon Bertrand. *Ceramique*, **25**, 153–157(1922).—The relation between the Al_2O_3 content and fusibility of 101 clays were studied and the results are summarized in the following table:

% Al_2O_3	No. of clays	Softening temps. °C	% Al_2O_3	No. of clays	Softening temps. °C
39	1	1840	25	5	1450–1790
38	1	1850	24	4	1450–1800
37	1	1830	23	8	1390–1790
36	3	1190–1830	22	7	1440–1790
35	2	7790–1800	21	3	1270–1730
34	4	1810–1830	20	3	1120–1770
33	7	1670–1810	19	1	1450
32	2	1750–1810	18	1	1720
31	6	1670–1810	17	1	1650
30	3	1700–1790	16	4	1160–1710
29	5	1690–1790	15	1	1650
28	7	1430–1810	14	2	1460–1690
27	7	1500–1770	12	2	1390–1670
26	9	1470–1770	8	1	1650

The clays were classified into three groups as follows: I.—Clays containing more than 29% Al_2O_3 (more than 32% for fired clays). All clays in this group were fire clays having a softening point above 1650°C. II.—Clays in this group contain 20–28.9% Al_2O_3 (21.5–32% Al_2O_3 for fired clay). This group consisted of 53 clays softening between 1120–1810°C and 39 of these soften above 1650°C. III.—Clays in this group contain less than 20% Al_2O_3 (less than 21.5% Al_2O_3 for the fired clay). This group contains 13 clays which soften between 1160–1710°C of which 7 soften above 1650°C. Since those clays which have the highest Al_2O_3 content are generally the most refractory B. recommends that a minimum Al_2O_3 content be specified for clay refractories.

H. G. Schurecht

48. Open hearth furnace design. A. D. Williams. *Iron Age*, **109**, 577–9, 717–9, 853–5, 1075–6(1922); cf. *Ceram. Abs.*, **1**, 108(1922).—Design, computations and figures are based on known principles and chem. reactions that take place. The calcn. of the hearth area is such as to give a metal depth of about 29 in. in a 100-ton furnace. The inclination of parts varies with practice, being a function of speed vols., etc. The velocities of the gases det. the inclination of ports and similar openings. Regenerator computations for wt. and vol. of checker work require 50 to 70 lbs. per lb. coal burned per

reversal, the temp. changes being based on the time of reversals. For frictional resistance in the design of checkers and flues the formula of Mojarow is used. Calcns. of the gas and air necks, flues, etc., are also based on this formula. The consideration of the port areas and velocities of the gases is affected by the pressures as are also the angles and locations. The pressure of the gas may be from $^1/_2$ to 1 in. of water, but not more than the capacity of the flues for carrying off the gases. The height of the stack varies, depending on the use of auxiliary draft appliances.

W. A. MUELLER (*C. A.*)

49. Chromite deposits of Bahia, Brazil. H. E. WILLIAMS. *Eng. Mining J.*, **111**, 376–8(1921).—There is a large chromite deposit near Santa Luzia; lenses with amphibole in a quartzose gneiss. Extensive mining was carried on during the war.

E. F. H. (*C. A.*)

50. Alunite deposits in United States. RICHARD H. TINGLEY. *Rock Products*, **25**, No. 6, 38–43(1922).—A popular account of some of the alunite deposits in Utah and the prices and extent of the demand for K, alum and H_2SO_4 in the U. S. Roasting and treating with H_2O is the process proposed. The crude Al_2O_3 remains behind and the K_2SO_4 goes into soln.

J. O. HANDY (*C. A.*)

51. The preparation of refractory bodies for temperatures over 2000° in furnaces with reducing atmospheres. OTTO RUFF. *Forschungsarbeiten Gebiete des Ingenieurwesens*, **1914**, No. 147, 31 pp.—The only oxides or furnace linings which are sufficiently high-melting, non-volatile and resistant at 2000° to the reducing atm. of a C resistor are BeO, MgO and ZrO_2. Of these three ZrO_2 alone is practical; BeO is too expensive and MgO too volatile. The 2 latter can serve only as fluxes. Impervious crucibles can be prepd. from ZrO_2 which are resistant up to 2200° in an evacuated C resistance furnace. The addn. of dry starch makes ZrO_2 more easily molded. MgO increases the shrinkage at low temp., but gradually disappears at temps. above 2000°. Entirely impervious crucibles of ZrO_2 have not yet been made. The prepn. of impervious crucibles with TiC is very difficult; it is facilitated by the addn. of a small amt. of other carbides although good vitrification has not yet been obtained. The requirement is that the m. p. and the vitrifying point must occur at a rather wide difference of temp. ZrC_2 is about the only other carbide sufficiently stable to serve as the basic material for such crucibles. Suitably glazing porous C crucibles may prove possible and further work along that line is promised.

H. I. MATTILL (*C. A.*)

52. Vanadiferous asphaltites of central Peru. J. G. BARAGWANATH. *Eng. Mining J.*, **111**, 778–81(1921).—Vanadiferous asphaltites of the impsonite type are found in Junin and Lima, along the western Cordillera of the Andes of central Peru. They occur in lenses in limestone, and contain as much as 16% ash, 2–5% S, 1% V. Several analyses are given. Attempts to extract the V by burning and treatment of the ash have proven unprofitable.

EDW. F. HOLDEN (*C. A.*)

53. Cleaning producer gas without washing. J. H. MATHESON. *Iron Age*, **109**, 916–7(1922) 4 figs.—Description and advantages are given of an installation for mixing the gases from several producers and removing the dust therefrom by an impact and settling process. A saving of 20–25% of the fuel is made. The dust recovered is valuable as a fuel.

J. L. WILEY (*C. A.*)

54. Chemistry and physics of gas works refractories. T. F. E. RHEAD. *Gas World*, **76**, 225–7, *Gas J.*, **157**, 633–6(1922).—Attention is drawn to the influences of grading, proportioning, mixing, molding pressure, burning, etc. J. L. WILEY (*C. A.*)

55. The application of electric power in the iron and steel industry. W. S. HALL. *Assoc. Iron Steel Elec. Eng.*, **4**, 127–51(1922).—H. discusses the various sources of waste heat from steel plants and its conversion into elec. power. Also in *J. Western Soc. Eng.*, **27**, 145–57(1922).

W. E. RUDER (*C. A.*)

56. California silica sand operations. (GUNNEL) **18.** Preparation of refractory bodies for temperatures over 2000° (RUFF) **4.** (*C. A.*)

PATENTS

57. **Carbon electrodes; abrasives.** W. G. MICHEL. Brit. 174,529, Feb. 11, 1921. C electrodes for electrolysis, furnaces, arc lamps, or batteries, are made of abrasive bodies, such as are used for grindstones, emery wheels, and hones, by compressing the powdered C, emery, carborundum, etc., in a mold, exhausting air from the mold, allowing heated binding material to permeate the powder, and baking the resulting bodies. A suitable construction is specified. Cf. *C. A.*, **15**, 3033. (*C. A.*)

58. **Electric crucible furnace.** W. S. HADAWAY, JR. U. S. 1,410,566, Mar. 28, 1922. (*C. A.*)

59. **Electric arc furnaces.** F. VON SCHLEGELL. Can. 216,774, Mar. 14, 1922. A pair of parallel electrodes is inserted in a chamber in proximity to each other in such a way that the distance between them may vary under the influence of the magnetic fields set up in the furnace. An auxiliary electrode movable to contact with the pair of electrodes to form an arc may also be provided. (*C. A.*)

60. **Manufacture of refractory and insulating products.** G. L. DIMITRI AND J. E. DELAUNAY. Can. 217,417, Apr. 4, 1922. A natural Mg silicate is mixed with other silicates; the mixt. is compressed, dried, formed into blocks and fired at about 1450° in a muffle furnace. The compression may take place in a vacuum. Cf. *Jour. Amer. Ceram. Soc.*, **4**, 865 (1921). (*C. A.*)

61. **Electric furnace for zinc purification.** H. TSUBOI. Jap. 38,656, May 14, 1921. Diagrammatical description of an elec. furnace for purification of Zn by distn. A plug having a small hole is put in the delivery hole of the condensing chamber, by means of which formation of powdered Zn is prevented. (*C. A.*)

62. **Tilting electric furnace.** W. E. F. BRADLEY AND A. B. BRADLEY. U. S. 1,411,158, Mar. 28, 1922. (*C. A.*)

63. **Electric crucible furnace.** C. H. CARPENTER. U. S. 1,409,669, Mar. 14, 1922. (*C. A.*)

64. **Refractory cover for electric furnaces.** M. S. CLAWSON. U. S. 1,410,654, Mar. 28, 1922. (*C. A.*)

Abrasives

65. **Corundum Industry in the Northern Transvaal.** A. L. HALL. *South African Jour. of Indus.*, **5**, 153(1922).—The Transvaal corundum fields extend over some 2000 sq. m. The keen competition in the industry has necessitated changed methods of recovery and grading. The principle of concentration of corundum from crushed reefs by mech. methods similar to those used in tin mines, has been thoroughly tested and in this way it has been demonstrated that superior grain corundum of marketable quantity can be economically produced in the Transvaal fields by methods much less elaborate than those in use at the famous Craigmount Mill in Canada, now burnt down. Crushing, concg., and grading are fully described with an accompanying "Flow Sheet." A wheel made of this grain corundum passed a severe test in London very satisfactorily. Since it is possible to produce well-graded commercial grain corundum of high quality economically, and to furnish abrasive material of great purity and high alumina percentage, the general outlook of this new industry in South Africa is distinctly encouraging. O. P. R. O.

Stoneware, Whiteware and Porcelain

66. **The use of electrolytes in the purification and preparation of clays.** H. G. SCHURECHT. *U. S. Bureau of Mines Tech. Paper*, **281**(1922).—The following subjects are covered: (1) relation of salt to clay in the purification of clays, (2) use of

H_2SO_4 in the sedimentation of clays, (3) effect of electrolytes when added to plastic bodies, and (4) effect of wet grinding, screening, electrolytes and dextrine on clays of low plasticity. H. G. S.

67. The grinding and preparation of raw materials in the whiteware industry. B. WILDE. *Keram. Rundschau*, **30**, 167, 168(1922).—With the substitution of machinery made for handmade ware, the proper preparation of the bodies becomes more important. The grinding mills should be set up in a clean, well lighted place and the floor of the grinding room should be of cement or tile with sufficient grade to allow them to be easily cleaned and drained. Extreme cleanliness is necessary in the grinding room, the mills should be cleaned every evening and no one should be permitted to enter with soiled shoes. The room should be well heated and lighted in the winter to allow the men to work more efficiently. Drops of oil from machinery should not be allowed to enter the clay since these contain iron which would discolor the ware. The blunger and agitators should be covered. As much as possible of the equipment should be made of wood instead of iron. Before mixing water with the clay the latter should be thoroughly dry since wet clays do not mix as easily as dry clays. H. G. SCHURECHT

68. Manufacture of culinary ware. F. BIGOT. *Rev. Mat. Constr. Trav. Pub.*, **151**, 53B–54B, **152**, 68B–71B (1922).—The making of culinary ware from clays found at Vallauris, Switzerland. Chemical analyses of the clays found at different depths are given. LOUIS NAVIAS

69. Proper design of porcelain insulators. J. F. SCHEID AND W. WEICKER. *Elektrotechn. Z.*, **43**, 564–5(1922). C. G. F. (*C. A.*)

PATENTS

70. Molding earthenware, etc. W. A. VAN DIJK. Brit. 174,918, Jan. 16, 1922. Earthenware, etc., is molded by introducing the prepd. liquid material into a rotating mold having recesses corresponding in shape to the required articles, the material being forced into the recesses by centrifugal force. Exterior projecting wall portions may replace the recesses, and cores for hollow articles may be provided. (*C. A.*)

Art and Design

71. The use of secondary reference standards in process problems of color measurement. H. S. BUSBY. *Amer. Soc. Test. Mat.*, **21** (1921).—A discussion covering the fundamentals and practical problems involved in setting up an effective textile color lab., for routine color testing of the material of regular process problems. Application and discussions. F. H. R.

PATENTS

72. Plating on porcelain or glass. S. YUNOKI and Y. NAKAZAWA. Jap. 38,689, May 21, 1921. Lavender oil or an aq. soln. of Ag_2O is painted on porcelain or glass and heated at about 600° in a muffle furnace, whereby Ag_2O is fused on the surface which is further plated by a suitable method. When the m. p. of the material is not high, a mixt. of 1 pt. Ag_2O and 0.1 pt. solvent, made of 1 pt. minium, 2.2 pts. borax and 0.5 pt. Bi oxide, is used instead of Ag_2O and heated at about 380°. (*C. A.*)

Heavy Clay Products

73. Building tile from slag. ANON. *Contract Record*, **63**, 361(1922).—The National Slag Products Ltd. was incorporated in July, 1921, under Dominion Charter for the purpose of mfg. hollow building tile from granulated blast furnace slag, a waste material secured by long term contract from the Steel Company of Canada, Hamilton, Ont. Capital $300,000. The plant is situated at Hamilton and production was to have started May 1, 1922. O. P. R. O.

74. The making of clay brick. CH. BRAILLION. *Rev. Mat. Constr. Trav. Pub.*, 152, 74B (1922).—B. refutes the assertion that lime-silica brick can not be made with argillaceous sands. Sands containing up to 20 per cent clay were mixed with slaked lime, and made into good brick, without any difficulty. A mixture of pure clay and lime gave a resistant product. Special precautions have to be taken when pure sand and clay are used with the lime. LOUIS NAVIAS

75. A new building material. ANON. *Raw Materials Review* (London), **1**, 54 (1922).—Paul Atterfelt, of Gothenburg, Sweden, has contrived a new building material made of a compn. of wood fibre, by which complete buildings, walls, etc., of any kind may be made. While one cu. m. of brick costs 144 kronen finished today, the cost of the new material would only be 35 kronen. It is particularly easy to work, and can be sawed and planed. It has a large bearing surface, and has almost double the heat-insulating value of wood. O. P. R. O.

76. Treatment of silicates for alkaline sulfates. (A process by E. Levitt, of Montreal, Canada). ANON. *Raw Materials Rev.* (London), **1**, 54(1922).—According to this specification, silicates such as potassium-bearing silicates and clays are fused with boron trioxide or any substance that yields boron trioxide at a high temperature, and then treated with sulfur dioxide. Bisulfites of the metals present pass into soln., while silica remains undissolved and is filtered. The filtrate is boiled, sulfur dioxide is evolved, the bisulfates converted to sulfites, and aluminium pptd. as hydroxide. The ppt. is then filtered, and the filter boiled, thus dioxidizing with access of air the sulfites to sulfates. O. P. R. O.

Glass

77. Recuperative glass furnace. ANON. *Glass Worker*, **41**, No. 34, 11(1922).—The new Chapman-Stein furnace is described. Increased capacity, longer life of pots, reduced fuel consumption and better temp. control is claimed. R. J. M.

78. Some aspects of science applied to the glass industry. C. H. KERR. *Glass Industry*, **3**, 69–71(1922). J. B. PATCH (*C. A.*)

79. The production and properties of optical glass. F. WEIDERT. *Glashütte*, **51**, 774–5, 787–90, 803–5, 819–21(1921); **52**, 1–3, 17–18(1922), 9 illus.—See *Ceram. Abs.* **1**, 116 (1922). J. B. PATCH (*C. A.*)

80. Specifications for lime-flint glass tumblers. ANON. Bur. Standards, *Circ.*, No. 119, 1–3(1922). G. E. BARTON (*C. A.*)

81. Pyrex: a triumph for chemical research in industry. W. H. CURTISS. *J. Ind. Eng. Chem.*, **14**, 336–7(1922). J. B. PATCH (*C. A.*)

82. A radiation electric glass furnace. V. M. SAUVAGEON. *Chimie et industrie*, **7**, 452–5(1922).—Outline of the expts. carried out by S. from 1908 to 1914. The first furnace, heated entirely by passing the current through the charge, was not satisfactory because the heat was too concd. and caused rapid wear of the pot, while the passing of the current through the glass prevented obtaining a flawless product. In the next furnace, a heating element was placed in the roof of the furnace and the current was also passed through the charge, and finally all the heating elements were placed in the roof and the walls and no current was passed through the charge. In this last furnace the lower portion, built of refractory materials, comprised a seat for the melting pot, raised in such a manner that natural ventilation could take place under the floor supporting the pot. The walls and roof were of MgO, contg. at least 7% Fe oxide. There were 3 chambers, each contg. a resistor of fine-grained petroleum coke (which became graphitized when the furnace started up), and the electrodes passed through the ends of the furnace. Above each chamber is an opening which allows the inspection of the resistor, even when the furnace is running, and by means of which the coke is renewed.

The roof and walls were purposely made quite thick. Single phase a.c. was used. The furnace was run from June 11 to July 18, 1914, when it had to be shut down through wearing out of the pot. The roof and walls were taken down for inspection and were seen to be in excellent condition. The tests showed: The furnace is of sturdy construction, easily inspected, even when running, and simple to control. It can be started up directly. Interruption of the current involves no drawbacks other than stopping of production during the time the current is off and the time required for bringing the furnace back to its working temp. It is perfectly safe, as there is no current passing through the working part of the furnace. There is no deterioration or transformation of the charge. Temps. all the way up to 1,425° can be obtained and maintained very closely. The roof was constructed too thick. Reduction of the thickness would allow of higher temp. and better yield per kw. Good quality glass can be manufd., and with some minor changes the furnace is suitable for com. operations. Owing to high and const. temp., better and more resistant glasses can be obtained, and more particularly SiO_2 glasses with a high insulating power. The tests are being continued.

A. P.-C. (*C. A.*)

PATENTS

83. Glass. W. C. Taylor and H. P. Gage. U. S. 1,411,133, Mar. 28. A glass opaque to visible light in plates 6 mm. or more in thickness is formed by the addition of MnO_2 6% and Cr_2O_3 0.5% ($K_2Cr_2O_7$ 1%) to a SiO_2 46, PbO 33 and K_2O 14 part glass. U. S. 1,411,134 relates to production of similar glasses. (*C. A.*)

84. Care of glass melting pots. H. W. Hess. *Glass Worker*, **41**, No. 29, 14, 22, 24(1922).—In heating the pots in the pot arch uniformity of temp. is of greater importance than the length of time consumed in reaching the max. temp. of 2100–2200° F. The moisture is driven off at 230° F., and the greatest loss in wt. occurs between 900° and 1200° F. J. B. Patch (*C. A.*)

85. The action of iron and other metals upon clay and glass. H. W. Hess. *Glass Worker*, **41**, No. 27, 12, 36(1922).—When introduced with the batch pieces of Fe, Cu, brass and Pb have little or no effect upon the pot itself. If the metal is introduced after the metal is planed decided erosion takes place upon the refractory container.

J. B. Patch (*C. A.*)

86. Control of pot furnace conditions. H. W. Hess. *Glass Worker*, **41**, No. 32, 11, 29, 30(1922).—The essential uniformity of heating can only be obtained by intelligent pyrometric control. J. B. Patch (*C. A.*)

87. Magnetic separation in glass plants. R. A. Manegold. *Glass Worker*, **41**, No. 30, 11, 29(1922).—The magnetic separator is useful in removing tramp Fe from cullet and in reducing the Fe content of sand. J. B. Patch (*C. A.*)

88. Unbreakable glass? Anon. *Fachgenosse*, **38**, 39–40(1922).—The new glass, Silex, made by Horak, is composed of 98% quartz. Its coeff. of expansion is so small that beakers and flasks with 1-mm. walls withstand abrupt temp. changes of 400°. The glass is also very resistant to severe shock tests although not unbreakable. The color is described as smoky yellow; the color is due to the action of S_2 in the fuel. Silex is expected to replace metal and enamelled cooking utensils. J. B. Patch (*C. A.*)

89. Determination of the surface of glass powder. Hans Wolff. *Z. angew. Chem.*, **35**, 138–40(1922).—A soln. of 290 g. Na_2CO_3, 10 H_2O and 50 g. NaOH, pure and especially free from iron, was placed in a silver vessel heated on a water bath to 95°, and allowed to act (*a*) for 2 hrs. on glass plates of known sizes held in clamps, and (*b*) for ½ hr. on carefully sieved and washed glass powder of the same compd. as the plates, and agitated by stirrers of special form driven at 300 and 400 revolutions per min., resp. Loss in wt. of plates and powder was detd., calcd. to loss for 2 hrs., and the surface of the powder then computed from the equation: surface of powder/surface

of plates = loss in wt. of powder/loss in wt. of plates. For purposes of comparison such results were then reduced to "surface per gram" and "surface per cc." It was found that plates must be of the same kind of glass as the powder to be examd., and that the ways different kinds of glass splinter vary widely. Values for the surface of the same glass vary about 5–6% from the mean, and those for different kinds of glass by 20–30%. Expts. were carried on with 3 kinds of Jena glass, a window glass and glass for photographic plates, the Jena glass showing relatively smaller areas per g. and per cc. (and also lower hardness) than the other varieties. W. C. EBAUGH (*C. A.*)

90. Heat distribution in the glass factory. ANON. *Nat. Glass Budget*, **37**, No. 50, 8–9(1922).—The Denk Engineering Co. gives the following heat balance of producer gas as typical for glass furnace conditions: 20% of the total heat value of the fuel is lost in the producer, 5% in the gas line, 4% in the chamber, 32% in the furnace and 26% in the stack. The useful heat consumed by the glass is thus 13%. Proper insulation and clean gas are recommended to reduce the losses. J. B. PATCH (*C. A.*)

91. Annealing and the mechanical properties of glass. TAFFIN. *Compt. rend.*, **174**, 159–62(1922); cf. *Ceram. Abs.*, **1**, 216(1922).—Using the mathematical expression developed in a previous paper T. dets. the effect of forces applied to prisms of glass on the birefringence of the glass. The force necessary to cause a continuous deformation of glass at 410° corresponds to the value that may be obtained from the mathematical expression. Conclusion: The annealing of glass is a viscous deformation due to internal forces. L. H. RYERSON (*C. A.*)

92. Determination of sulfate-, chloride-, and carbonate-ions in soda-lime glass. MASAO IKAWA. *J. Chem. Soc. Japan*, **42**, 768–85(1921).—I.'s new method is based on the use of NH_4FHF to dissolve the glass instead of HF. Since the com. fluoride contains $PbSO_4$, PbF_2, NaF, Na_2SO_4 and Fe as non-volatile impurities, and NH_4 salts of H_2SO_4, HCl, H_2SiF_6 as volatile impurities and sometimes free H_2SO_4 and $(NH_4)_2SO_3$, a special method of purification is necessary according to the ion to be detd. SO_4-free fluoride is prepd. as follows: Into a hard glass flask 3 l. capacity (need not be Pb flask), about 400 g. of silicate powder (or common glass powder) mixed well with 200 g. of NH_4FHF are placed, and treated gradually with com. H_2SO_4. The resulting SiF_4 is led into 2 l. of H_2O in which H_2SiF_6 is formed (the clogging of the end of the tube by H_2SiO_3 is prevented by a little Hg placed in the flask). After the H_2SiO_3 is filtered off, the H_2SiF_6 is first neutralized with NH_4OH, and then decompd. by adding a large excess of NH_4OH. The clear filtrate is transferred to a Pt dish. NH_3 is driven off, and on cooling NH_4FHF crystallizes out. The crystals, after being freed from H_2O as much as possible, are purified by sublimation. The product is free from SO_4. The powd. glass to be analyzed is decompd. with about 9 g. of the purified NH_4FHF. If the fluid is neutral or alk. to litmus, more fluoride should be added. The resulting residue is dissolved in a small amt. of warm H_2O (the small insol. residue is CaF_2). The filtrate from the CaF_2 is neutralized with SO_4-free Na_2CO_3, and heated, filtered, and the residue washed 3 times on filter paper with dil. alc. (1:1). The filtrate is concd. to approx. ½, acidified with excess of $H_2C_2O_4$ and heated. The filtrate from the $H_2C_2O_4$ is evapd. to dryness and the excess $H_2C_2O_4$ destroyed by gentle ignition. The residue is dissolved in dil. HCl, filtered and the SO_4 detd. by $BaCl_2$ as usual. For Cl detn., the com. fluoride is freed from Cl by $AgNO_3$. The filtrate is treated with NH_4OH, and again filtered. From the filtrate, NH_4FHF is crystd. by concn. and cooling, and purified by sublimation. About 5 g. of the sample glass should be used for a Cl detn. For CO_3 detn., the crude fluoride is dissolved in H_2O, and treated with NH_4OH. The filtrate is evapd. in a Pt dish to drive off NH_3. The residue is recrystd. Then about 15–20 g. of glass powder is decompd. by the fluoride and CO_2 is detd. by a slight modification of Fresenius-Classen's method. The results of analyses of various im-

ported window glasses show that SO_4 (as Na_2SO_4) varies from 0.667 to 1.045%, non-sulfate S (as Na_2SO_4) from 0 to 0.108%; Cl as NaCl from 0.066 to 0.154%; and CO_3 as Na_2CO_3 from 0.021 to 0.055%. S. T. (*C. A.*)

93. The action of metallic lead in pots. Henry W. Hess. *Glass Worker*, **41**, No. 28, 14, 22(1922).—Six duplicate tests using finely divided Pb in place of litharge yielded a first class glass and the pot bottom showed no ill effects. The Pb button sometimes found on pot bottoms is believed to be harmless, at least as far as chem. action on the pot is concerned. J. B. Patch (*C. A.*)

PATENT

94. Means for feeding goods into and removing goods from annealing and other furnaces. Martin van Marle. England, 1,402,551, Jan. 3, 1922. Apparatus for charging or discharging furnaces, comprising (1) a traveler adapted to move transversely, (2) a cross frame carried by the traveler having rails, (3) a goods carrying carriage mounted on the cross frame and adapted to move on the rails, (4) longitudinally disposed goods-carrying bars movably mounted above the carriage and adapted to carry the goods into or remove them from the furnace (5) means for raising and lowering the bars on the goods carriage, (6) means for moving the carriage longitudinally to carry the goods bodily into the furnace. C. M. Saeger, Jr.

Cement, Lime and Plaster

95. Cement industry. Punjab, India. Anon. *Jour. Royal Soc. of Arts*, **70**, 505.—It has been said that the measure of a country's prosperity may be gauged in these days of industrial progress by the extent of its cement interest. The recent industrial awakening of India has generally synchronized with the development of the manuf. of Portland cement in various ports of the Peninsula. The Governor is to possess a cement factory of his own. The site for the plant is Wah, in an area of an almost inexhaustible supply of limestone and clay of admirable quality for the manuf. of first-class Portland cement. Abundant supply of clear cold water from the Himalayas is available here. The whole of the plant will be driven elec. by a steam-driven turbogenerator of 1,500 kw.—probably the most modern unit of its type in the Punjab. O. P. R. O.

96. Gypsum in British Columbia. A. G. Bangley. *Ann. Rept. B. C. Minister of Mines*, G. **129**(1921).—A deposit of gypsum occurs along the North Bank of the Bull River in the Eastern District of B. C. at a distance of about three miles from the main road to Fort Steele and within a short distance of the falls and the Kootenay Central Railway. The deposit has considerable overburden but shallow diggings have uncovered the mineral, and from all indications there is a large deposit conforming to the dip and strike of the formation. The analysis of a representative sample gave the following results: Gypsum, 80.5; carbonate of lime, 14.4; insoluble, 3.5; magnesium oxide, 0.6; organic matter, 0.8. Another large deposit of gypsum has been opened near the railway at Kelly Lake in the Lillooet District. O. P. R. O.

97. Standard specifications for Portland cement. Anon. *Canadian Eng. Standards Assoc.*, (1922).—The specification is based on the recommendation of the Engineering Institute of Canada, but agrees substantially with the Tentative American Standard Specification, while certain clauses have been adopted from the British Standards Specification. It takes into account the most modern developments of cement manuf. testing and use, both on this continent and Europe. Chem. properties, phys. properties, packing and marking, inspection and rejection of cement are outlined. This specification differs from the American and British Standards in cases where Canadian conditions require distinctive treatment. O. P. R. O.

98. **New methods for proportioning concrete.** R. B. Young and T. V. McCarthy. *Canadian Engineer*, 9, 263–65.—Basis of the new theory is the idea of proportioning concrete to develop desired minimum strength in a specific time. Four classes of concrete have been established by the Hydro-Electric Power Commission, each to develop stipulated strength at the age of 28 days: (1) Class A, 2,500 lb. per sq. in. (2) Class B, 2,000 lb. per sq. in. (3) Class C, 1,500 lbs. per sq. in. (4) Class D, 1,000 lb. per sq. in. These correspond roughly with the common proportions 1:1½:3, 1:2:4, 1:2½:5, and 1:3:6. This plan is much more logical than specifying a set of mixts. because, for example a 1:2:4 mix may under certain conditions give a strength as low as 500 lbs. per sq. in., and under more favorable conditions a strength of 4,000 lbs. per sq. in. To the man in the field consistency is a more important feature than strength. Nevertheless he controls to a great extent, the strength of the resulting concrete by making the consistency conform to an adopted standard. The Hydro-Electric Power Commission has attempted to proportion concrete, not only for a given strength but for a given consistency. This was impossible by the former methods of proportioning and mixing but the development of this new method makes a stated strength and a stated consistency possible. The Commission has also used the water-cement-ratio strength relationship, changing the ratio to correspond to weights rather than to volumes, in order to facilitate the work of proportioning. The Commission has chosen the conditions under which the minimum variations occur and has found the theory most successful. A standard consistency has been arrived at by trial and the quantities of water necessary to produce this consistency have been determined for various mixes. The denser the concrete the greater its strength. It is possible to predict within a few hundred pounds the possible strength of concrete proportioned by the new method. O. P. R. O.

99. **On the choice of materials for use as sand in hydraulic mortars.** R. Feret. *Rev. Mat. Constr. Trav. Pub.*, **150**, 45–49, **151**, 71–76, **152**, 85–90(1922).—*First series.* Mortars were made by mixing by weight 1 part of Portland cement and 3 parts of sand. The sand or material representing it in the mortar was separated into divisions of large grains G, (passing through screen of 5 mm. diameter hole but held by 2 mm.), medium sized grains M, (through 2 mm. but held by 0.5 mm.), and fine sized grains F, (those passing thru 0.5 mm.) Equal weights of each size were taken and mixed to represent the material. The materials tested were *natural rocks* as (A) porphyry, (B) granite, (C) siliceous stone, (D) ferruginous stone, (E) calcareous stone—50% lime, (F) marble, (G) chalk, (H) crushed shells, (I) flint, (J) schist, quartzite in (K) angular grains, (L) lamellar grains, and (M) rounded grains, (T) feldspar, substitution of 2.5% (U) mica, 5% (V) pyrites, 33% (A^1) dry clay, and 33% (B^1) mud, separately in the quartzite mixture. The effect of *substances having chemical action on cements*, (P) crushed new brick, (Q) cinders, (R) slag—(used in cements): substitution of 33% (W) trass-volcanic product, 33% (Y) manganese dioxide, 7% (Z) sawdust, 33% (C^1) coal ashes 33% (D^1) wood ashes, separately in the quartzite mixtures. Inert substances as (O) pumice stone, (N) crushed glass, (S) wood charcoal: substitution of 66% (X) broken pieces of unground cement in quartzite mixture. The materials were mixed with enough water to give them the same plasticity, for the mortar, and then molded into briquettes. After hardening in the air 7 days, the mortars were immersed in sea water and tested after periods of 12 weeks, 1, 4 and 10 years. Data given in tables: proportions of mixtures, weights of water needed for mortar, change of weight of 1 liter of mortar on standing, and tensile strength after each period of immersion. Tests on 10 year immersion samples only:—(1) stamp test (directly proportional to compression strength). The center of a crushed sample was powdered and treated as follows:—(2) 5 gm. were dried to constant weight in a sand bath—the loss in weight indicating the amount of

water held in the pores by capillarity, (3) 5 gm. were put into 150 cc. of a 10% sugar solution in a stoppered flask, and frequently shaken: at the end of 24 hours the liquid was filtered and the lime dissolved in it was determined by hydrochloric acid, the results giving a relative idea of the proportion of free lime found in the different mortars. From these data the amount of free lime found in the dried mortar was calculated. *Results.* Only slight differences in strength were noted where rock substances A-M, T and U were used. Compression tests after 10 years immersion gave, when calculated so that value of (K) ground quartzite is 100:—(P) 165, (X) 141, (I) 139, (N) 134, (V) 113, (Q) 107, (C^1) 104, (M) 103, (D) 103, (A) 101, (K) 100, (W) 97, (T) 96, (A^1) 93, (Y) 92, (H) 91, (L) 90, (F) 88, (E) 83, (C) 83, (B) 81, (U) 81, (R) 67, (D^1) 65, (J) 58, (B^1) 56, (Z) 39, (G) 29, (O) 25, (S) 8. The rounder the grains of the material, the greater the strength of the mortar. The introduction of dry clay did not change the strength of the mortar materially. Dry mud (containing much organic matter) lowered the strength considerably. *Second series.* Mortars were made with proportions of binder to sand of 1 to 3, and 1 to 7, by absolute volumes. With hydraulic lime the materials used were, (Q+R) quartzite, (P) granitic sand, (X) marble, (U) broken red ridge pieces. With Portland cement were mixed (Q+R), (P), (X), (U), and (Y) calcareous sand, (Z) calcareous oölite, (V) broken yellow ridge pieces, (T) crushed brick. Each material was sieved thru circular openings of diameters 5, 4.5, 4, 3.5, 3, 2.5, 2, 1.5, 1, and 0.5 mm. and thru screens of 80 and 180 mesh, that greater than 5 mm. was rejected. The 12 screened sizes were then mixed together, a constant weight being taken for each size. Enough water was used to give each mortar the same plastic consistency. The following data are given:—specific weights, and specific volumes of the materials, cements and mortars, tensile and compression strengths for test pieces kept in media of sea water, soft water and moist air for periods of 12 weeks, 1 year and 6 years, stamp tests for sea water samples after 30 years immersion. If c and s represent the absolute volumes of binder and cement respectively in 1 volume of fresh mortar, it has been found that when the quantity $\left(\frac{c}{1-s}\right)^2$ is plotted against the corresponding compression or stamping strengths, for mortars made of the same binder and of different inert sands, and measured after immersion in the same medium for the same length of time, that the points lie practically on a straight line passing through the origin. (Several sets of data and graphs given.) Where there is pozzuolanic action, the points do not lie near the line-substances as non-granulated slag, granulated slag, trass, red and yellow ridge pieces, and crushed brick acting in this manner. *Third, fourth and fifth series* corroborate the above straight line relationship for other hydraulic binders, and for different grain size mixtures. *Sixth series.* Quartzite, marble, and dolomite in weight proportions of 5, 4, 3 and 2 to 1 of cement with about 14% water gave similar resistances for each proportion. For a constant immersion period in the same medium the compression strengths when plotted against the respective quantities $\left(\frac{c}{1-s}\right)^2$ gave a straight line relationship. *Seventh series.* Iron rust, iron ore and rusted grains of iron were mixed separately with Portland cement in varying proportions with and without sand. Denoting the absolute volume of the ferruginous material in a unit volume of mortar by m, then plotting the compression strengths against corresponding values of $\left[\frac{c}{1-(s+m)}\right]^2$ gave practically a straight line relationship. *Conclusions.* Mortars of most inert materials in the form of crushed rocks or sands with the same hydraulic binder are very similar in strength, and only differ in this property on account of grain size. The effect of grain size of the sand on compression strengths is neatly shown on

a triaxial diagram having G, M and F sizes (Q. V.) as apices, and curves of compression strengths of 310, 300, 250, 200, 150 and 100 kgs. per sq. cm. drawn on it. The mortar was that of 1 part cement and 3 parts quartzite. The maximum strength was obtained with a mixture of 5:1 of sizes G:F. The strength decreased very rapidly towards G and only slowly towards F and M. LOUIS NAVIAS

100. **Sand-lime brick and sand-lime mortar.** R. P. BROWN. *Rock Products*, 25, No. 6, 36–7(1922).—Sand-lime brick contain approx. 10% by wt. or 25% by vol., of hydrated lime. If sand and lime mortar contg. 1 pt. of lime to 3 of sand be used for setting sandlime brick the structure will be practically monolithic and therefore of max. strength. The smooth working qualities of sand and lime mortar make even bedding of bricks easy. The mortar has a strength of 1622 lbs. per in.^{2} on an av. or 16 times the allowed safe load. It is also more adhesive than cement mortar. The crushing strength of cement mortar (1:3) was increased by 10% by substituting lime for half the cement. Ten % of lime added to cement mortar increased its adhesiveness (to bricks) by 130%. Bricklayers can lay 30 to 50% more brick per day in lime mortar.

J. O. H. (*C. A.*)

101. **Lime burning in the rotary kiln.** A. E. TRUESDELL. *Rock Products*, 25, 24–30(1922).—A brief historical review of the art is followed by consideration of the main facts on which efficient plant design must be based. The rotary kiln handles spalls and other fine sizes most efficiently. Dust must not be used and fuel consumption is high if stone larger than 1½″ is used. Uniform burning and high output require close sizing and fine stone; 10% less fuel was used for ⅛″ than for ¾″ stone. Kilns are 6 to 8 ft. outside diam. and 100 to 125 ft. long. They are lined with fire brick, or with silica brick for the lower 20 ft. if sizes above 1 in. are to be burned. The former only last about 5 months at that part while the latter stand twice as long if set so as to permit expansion. The kiln is set at 4 to 5% slope and is rotated at ⅕ to 1 r. p. m. as required. Magnesian limestone burns faster and may be used in larger sizes or put through faster with less fuel. Gas or oil fuel is best. Powd. coal unless very low in ash contaminates the lime. Producer gas should be of uniformly high grade and well mixed by introducing it under preheated air from the cooler. The latter should be from 30 to 50 ft. long by 4 or 5 ft. in diam. Feeding of the stone from an elevated bin is automatic as the kiln runs. A dust chamber is located between the kiln and the stack. A waste-heat boiler with proper facilities for dust removal is desirable. Operating cost with an 8×125′ kiln, heated with producer gas, electrically driven and turning out 60 to 75 tons of lime each 24 hrs. for 300 days per year may vary from $3.45 to $8.47 per ton of lime made. The lower figure is based on 12 hr. shifts and 30c. per hr. wage, the higher on 8 hr. shifts and 50c. wage. Magnesian stone, coal at $5.00 per ton (4½ lbs. lime per lb. coal), power 1c. per kw.-hr. and $9.00 less per day for repairs and fixed charges are the basis of the lower cost figure. $90,000 to $100,000 plant investment is required. Rotary kiln lime burning needs further fuel-saving devices.

J. O. HANDY (*C. A.*)

102. **Sound-proof partitions.** F. R. WATSON. Univ. Ill. Eng. Expt. Sta., *Bull.*, 127, 78 pp. (1922).—A compilation of available information on methods for insulating sound, with special reference to the needs of architects and builders.

H. L. OLIN (*C. A.*)

CERAMIC ABSTRACTS

Compiled by the

AMERICAN CERAMIC SOCIETY

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[1] The abbreviation (*C. A.*) at the end of an abstract indicates that the abstract was secured from the Editor of *Chemical Abstracts* by coöperative agreement.

General and Miscellaneous

1. Silica gel. Ed. *Quarry & Surveyors' & Contractors' Jour.*, **27**, 44(1922).—The hydrous silicic acid known as silica gel has properties which may be useful in various industrial processes. Among these it has been proposed to use this subs. in the sulphuric acid industry for the purpose of abstracting small quantities of sulphur dioxide from gas mixts. containing as little as $^1/_2\%$ of SiO_2. This property of silica is due to what is called adsorption. The hydrated silica is dried, washed and partially dehydrated, producing a porous solid which possesses remarkable powers of adsorbing certain gases and is also capable of being metalized by platinum salts, whereby catalytic properties are acquired. There seems to be a distinct future for silica gel.

O. P. R. Ogilvie

2. The preservation of stone. Noel Heaton. *Quarry & Surveyors' & Contractors' Jour.*, **27**, 56–61(1922).—This article gives preventive and preservative treatments, summarizing as follows: (1) New work can be rendered to a certain extent more resistant to decay by treatment with fluorsilicates, provided the strength of soln. and method of application is adjusted to suit the stone used. (2) No preservative treatment will be effective on faulty- or face-bedded stones. (3) Constructional methods of reducing decay (prevention of damp, effective carrying away of storm water, etc.) are more important than preservative treatment. (4) For outside work on old buildings no preservative at present known serves to preserve decayed stone for more than a limited period. The most economical treatment is dressing with soft soap and alum, renewed every few years. (5) In interiors, where the stone has been corroded by sulphur compds. baryta treatment is, in many cases, beneficial, but it should only be used with restraint and under careful supervision, and should be followed by distempering. (6) Preservative treatment should only be employed where it is certain that it can, at the worst, do no harm. For this reason, articles of unknown compn. should be avoided, and only materials used, the action of which is well understood. Progress toward the goal can only be obtained by constant exchange of experience and study of results.

O. P. R. Ogilvie

3. A scientific method of quarrying slate. Ed. Delcourt. *Quarry & Surveyors' & Contractors' Jour.*, **27**, 52–55(1922).—Mr. Delcourt describes at length the system which has been adopted with very satisfactory results, but has never been applied and is very little known outside the quarries supervised by himself. These quarries are worked by the Société Industrielle des Pyrenées, Labassére, Dept. des Hautes Pyrenées. The method is based upon the use of wire saws for quarrying slate; and after more than two years' experience at the quarries in question, the technical and economic results have exceeded all expectations. Figures and diagrams are given. O. P. R. Ogilvie

4. X-ray tests for stone. Ed. *Quarry & Surveyors' & Contractors' Jour.*, **27**, 167(1922).—In Germany attention is being given to the examn. of building materials by means of X-rays. Twelve kinds of clay were examd. and various structures were observed in the X-ray diagrams, giving clear indications as to the uniformity and arrangement of the clay subs. The most conspicuous advantages of the X-ray method as compared with other testing processes are its cheapness and rapidity as well as the ease with which it can be used without any elaborate or difficult prepn., independently of any chem. analysis or the use of transparent microscopic sections, on large samples as well as on small amounts of material. Other kinds of building material showed interesting variations in permeability to X-rays, the following being arranged in the order of increasing transparency: Concrete mortar, granite, limestone, basalt, bricks, Horitz granite, Dutch bricks (clinkers), porphyry, gypsum, sandstone. In the case of concrete, a layer only 3 mm. thick of the concrete was found to afford excellent protection against X-rays.

O. P. R. Ogilvie

5. Italian non-metallic industries. ANON. *Chem. Trade Jour. & Chem. Eng.*, **71**, 12(1922).—The Genoa correspondent for this jour. under title of "Notes on the Italian Chemical Industry" gives a résumé of Italy's imports for 1921, which show a very decided increase over 1920 for the non-metallic industries. O. P. R. OGILVIE

6. Industrial and structural minerals. ANON. *Min. & Eng. Record*, **26**, 253–254 (1922).—A comprehensive survey of the growth in production during this year is given in this article. A special rotary furnace, invented and patented by Messrs. Thompson and Oliver has been used in the treating of magnesite at the Pacific Roofing Co.'s plant on Industrial Island and has done excellent work. Lime, silica, feldspar and talc are among the other minerals reviewed. Reference is also made to all the well-known producers of brick and refractories, cement, gypsum, sand and gravel with details of progress. O. P. R. OGILVIE

7. Cold production of water resistant material. ANON. *Keram. Rundschau*, **30**, 280(1922).—The compn. is as follows: 375 parts flint, 51 parts limestone, 8 parts calcined clay, 3 parts calcined feldspar and 28 parts water glass. The first four ingredients are mixed dry and then the water glass is added after which it is immediately pressed and dried. H. G. S.

8. Informational needs in science and technology. CHAS. L. REESE. *J. Ind. Eng. Chem.*, **14**, 364–8(1922).—The great need and value of coördinated, available information are discussed with a broad point of view and the efforts and plans of the Natl. Research Council in its Research Information Service towards the fulfillment of this need are described. E. J. C. (*C. A.*)

9. The factor of safety in research. A. F. SHULL. *Science*, **55**, 497–505(1922).—An address. E. J. C. (*C. A.*)

10. Electroösmosis. PAUL BARY. *Chimie et industrie*, **7**, 640–50(1922).—A review, with bibliography, of the applications of electroösmosis to industrial processes. Also in *Chem. Trade J.*, **70**, 625–7(1922). A. P.-C. (*C. A.*)

11. A comparison between stationary and mechanical producers. A. L. CULBERTSON. *Nat. Glass Budget*, **38**, No. 3, 22–6(1922).—A detailed account of the Chapman floating agitator. The m. p. of the ash of gas coals is usually within the limits of 1900–2600°F. Corresponding to these temps. the blast temp. necessary to prevent clinkering in the producer varies from 148° to 108°F. J. B. PATCH (*C. A.*)

12. The pulverization of fuels. A. B. HELBIG. *Feuerungstechnik*, **10**, 114–9, 140–3(1922).—After giving the principles controlling the powdering of fuel, H. classifies the different kinds of machinery used for the purpose and describes and illustrates a typical machine of each kind. ERNEST W. THIELE (*C. A.*)

13. Improved low-temperature by-product recovery gas-producer process. POWER GAS CORPORATION. *Iron Coal Trades Rev.*, **104**, 576(1922).—The Mond gas-producer has been modified so as to combine the principle of low-temp. carbonization with the original Mond gas process. The process is one of complete gasification in which the volatile matter of the coal is converted into liquid products according to low-temp. methods, and the residual fuel entirely converted into producer gas. The transmission of heat to the raw coal is achieved in a gradual but effective and rapid manner by the use of the sensible heat contained in the hot producer gas evolved in the lower part of the producer without the intervention of retort walls. There are produced per ton of fuel about 115,000–120,000 cu. ft. of producer gas of 178 B. t. u. analyzing CO_2 8.3, CO 21.0, H_2 20.5, CH_4 4.9, N_2 45.3%, 15 to 24 gal. of low-temp. tars, and 90 lbs. of $(NH_4)_2SO_4$. The steam required in the process is about 1 lb. per lb. of coal gasified, the whole of which is decomposed. Air and steam superheaters are not required. Installation and maintenance costs are lower than for the original type of plant.
J. L. W. (*C. A.*)

14. Instruction of students in the use of technical literature; an unexploited phase of engineering education. E. H. McClelland. *Eng. Education*, **12**, 407–20(1922). E. J. C. (*C. A.*)

15. Relation of employer and employee as regards ownership of patents. Maurice Block. *Chem. Age* (N. Y.), **30**, 201–2(1922). E. J. C. (*C. A.*)

16. Current chemical patents and patent problems. Lloyd Van Doren. *Chem. Age* (N. Y.), **30**, 235–8(1922); cf. *C. A.* **16**, 1822. E. J. C. (*C. A.*)

17. Influence of patent law on the evolution of research. H. E. Potts. *Chem. Age* (London), **6**, 726–7(1922). E. J. C. (*C. A.*)

BOOKS

18. Jahr- und Adressbuch der Bau- und keramischen industrie. (Industrie der Steine und Erden, Glas und Porzellan.) 1920–1. Edited by R. Hanel. Vienna: Compassverlag. 328 pp. M 32. Reviewed in *Tonind. Z.*, **46**, 481(1922). (*C. A.*)

19. Taschenbuch für Keramiker. Berlin: Verlag Keramische Rundschau, G. m. b. H. 206 pp. Reviewed in *Z. angew. Chem.*, **35**, 211(1922). (*C. A.*)

PATENTS

20. Gas producer. H. G. Johnston. U. S. 1,412,118, Apr. 11. (*C. A.*)

21. Gas producer. W. B. Chapman. U. S. 1,412,921, Apr. 18. (*C. A.*)

22. Gas producer. F. M. E. Blass. U. S. 1,414,109, Apr. 25. (*C. A.*)

23. Device for selective absorption from gas in transmission lines. F. F. Uehling. U. S. 1,412,790, Apr. 11. (*C. A.*)

Apparatus and Instruments

24. The construction of electric steel furnaces. M. Guédras. *Technique moderne*, **13**, 497–501(1921).—A discussion of the construction of elec. steel furnaces and of the importance of interposing non-magnetic parts in the shell thereby preventing the presence of a closed magnetic circuit and elimination of induction at Foucault's currents, and of the necessity of adopting a spherical formula to obtain as complete a utilization of the energy as possible. A. P.-C. (*C. A.*)

25. Wood-Harry cleaner and concentrator. Anon. *Chem. Eng. Mining Rev.*, **14**, 142–3(1922).—A new type of concentrator for cleaning floated sulfide or other ores from gang and also for the primary flotation of sulfide ores has been developed at Mt. Lyell. The app. may also be used for cleaning fine coal or graphite. The concentrator consists of a series of atomizing wheels set in cells below the bottom of the box of the machine and driven at variable speeds by high-pressure water jets. Air is led into the cells so as to impinge on the blades of the wheels. Air bubbles generated by the wheels join those already in the primary froth or feed to the machine and so change the nature of the froth that it no longer holds the gang in suspension. Louis Jordan (*C. A.*)

26. Air bubble viscosimeter. V. R. Abrams, J. T. Kavanagh and Chas. H. Osmond. *Chem. Met. Eng.*, **25**, 665–6(1921).—A glass tube, 21 cm. long and from 5.2 to 5.3 mm. in internal diam., with 2 lines etched on it 10 cm. apart near the middle of the tube, is sealed off at one end. The tube is filled with oil and closed with a tight-fitting glass cap which encloses a vol. of air which will fill 1.7 cm. of the tube when inverted. The time required for the bubble to pass between the 2 marks is proportional to the viscosity in Saybolt seconds and the "factor" may be obtained by calibration with a sample of known viscosity. Variations should not be over 1% for oils having a viscosity between 80 and 475 sec. Saybolt. The use of diams. other than those given or of an unrestrained bubble is impracticable and, therefore, water can not be used for calibration. The caution is given that when oils are re-run repeatedly, the viscosity may change considerably. Eugene C. Bingham (*C. A.*)

27. A microscopic arrangement for the examination of opaque crystals. M. François and Ch. Lormand. *Bull. soc. chim.*, **29**, 366–74(1921).—No contrivance has previously been devized for rendering visible microscopically very small opaque or deeply colored crystals in all their details without deformation, halo or false colors. Various methods led to the development of 2. Lateral illumination by an incandescent Pt wire permitted perfect vision with objectives 7 and 8 but was discarded because of frequent fusion of Pt and heating of both the crystals and the objective. The method adopted consists of (1) an ordinary microscope with its objectives fitted on their lower face with a Ag concave mirror pierced by a hole; (2) an incandescent light placed in the microscopic axis with its rays rendered parallel to the axis by a lens; and (3) a glass slide with an opaque disk on which rest the crystals protected from the light passing from beneath. The curvature of the mirror must be such that the reflected light converges on the object, and consequently each objective must have its own mirror. The width of the mirror should be equal to or less than its radius of curvature. The opaque disks are made of various colors depending on the crystals, and vary from 0.75 to 3.0 mm. in order to cover the field of any size of objective. The source of illumination can be a 2–3 v. lamp, 1–2 cm. diam. set in an eye-piece so that the lens renders the rays parallel. Directions are given for the mech. construction of the complete contrivance. Crystals of Fe, Cr and Ni silicides, Hg_2NI, $Hg_7H_2NI_4$, HgS, etc., have been photographed by this method with remarkable results. C. C. Davis (*C. A.*)

Chemistry, Physics and Geology

28. Measuring kiln gases. Anon. *Brick Pottery Tr. Jour.*, **30**, 132(1922).—The meas. of the vol. of gases passing through the flues of a kiln or up a chimney is by no means an easy task, as these gases are charged with both moisture and dust, and can not be passed through a "pitot" tube. For many reasons sufficiently accurate results may be obtained by inserting a damper having a sharp orifice at its center, this orifice being 1″ or more in diam., according to the size of the flue. When the gas passes through such an orifice the vel. is greatly increased, some of the original pressure being converted into vel. pressure, while the static pressure of the gas which has passed through the orifice is lower than the original static pressure. The quantity (Q) of gas flowing through the pipe in cu. ft. per sec., is found by the following equation:

$$Q = 403\frac{CATh}{PD}$$

C is the coef. of flow (usually about 0.95–0.99), A is the area of the orifice, h the differential pressure (in in. of water) of the gas on each side of the orifice, P is the absolute pressure of the gas in in. of mercury, T is the absolute temp. in degrees C and D is the density of the gases referred to air at the same temp. There are difficulties connected with the meas. of the temp. and pressure of the gas, but when these are overcome the method is fairly accurate. H. G. Schurecht

29. Immense deposits of magnesite in southern Nevada. Anon. *Clayworker*, **78**, 29(1922).—A massive deposit of magnesite of unusual character has been found by the U. S. Geol. Surv. in Clark Co., Nev., in the valley of Muddy River a few miles from St. Thomas. This material has for some time been mistaken for kaolin but it was recently found to be a highly magnesian sedimentary bed. The material is porcelain white, fine-grained and massive, is remarkably free from foreign material, and has a structureless appearance and a conchoidal fracture. It is not as hard as typical magnesite. In places the deposit is 200 ft. thick. H. G. Schurecht

30. Colloidal clay production. St. Austel. *Quarry & Surveyors' & Contractors' Jour.*, **27**, 228(1922).—The possibilities of colloidal clay production continues to be

discussed as a means of extending the demand of china clay for new uses, but as yet the work is in the experimental stage. Colloidal clay results from the subjection of ordinary china clay to chemical treatment carried on in specially constructed tanks, between the washing and drying processes now applicable to ordinary china clay production. Colloidal clay may be said to be the essence of china clay, all impurities and deleterious matter having been eliminated or neutralized by the chemical treatment. It is claimed that the value of the clay thus purified is enhanced by pounds per ton at comparatively small cost. O. P. R. OGILVIE

31. Mineral resources of Jugoslavia. ANON. *Nature*, **110**, 34(1922).—This issue of *Nature*, in reviewing the report, "Geology and Mineral Resources of the Serb-Croat-Slovene State," states "Among the other minerals that have been or are being worked may be named bauxite, meerschaum and rock salt." O. P. R. OGILVIE

32. Mica in India. ANON. *Imp. Inst. Bull.*, **19**(1921).—In J. C. Brown's "Notes on Mica" (Bulletin, Indian Ind. & Lab., No. 15, 1921) he gives much information as to the industrial uses of mica, its specifications and standards, and brief notes on characteristics of the mineral and its production in India. Methods of trimming, grading, sizing, and splitting mica are described, as well as mica preparations, substitutes, prices and sources of supply, concluding with a summary of the outlook for Indian mica. O. P. R. OGILVIE

33. Some simplified formulas for excess air. JOHANN AGTHE. *Feuerungstechnik*, **10**, 113–4(1922).—Refers to the combustion of gases only.
ERNEST W. THIELE (*C. A.*)

34. Kaolin and kaolinized granite in the district between Strobel and Saarau, Silesia, and their formation. L. VON ZUR MÜHLEN. *Z. prakt. Geol.*, **1921**, 56–61.—Descriptions of several deposits are given, with analyses. The kaolin passes gradually into unaltered granite, and was formed by the action on the granite of the waters of Tertiary swamps, whose place is now occupied by lignite which was deposited in them.
E. F. H. (*C. A.*)

35. The volumetric determination of titanium dioxide in bauxite. H. J. WINCH AND V. L. CHAND-RATREYA. *Chem. News*, **124**, 231–2(1922).—Fuse 0.3 g. of the sample with 3 g. $KHSO_4$, dissolve the melt in hot dil. HCl and reduce the Fe^{+++} to Fe^{++} and the Ti^{++++} to Ti^{+++} by treatment with 0.15 g. of powdered Sn. Add an excess of $HgCl_2$ to remove the excess Sn and titrate Fe + Ti with standard $K_2Cr_2O_7$ soln. With another sample carry out the same procedure but in place of metallic Sn use $SnCl_2$ soln. as reducer, stopping as soon as the yellow $FeCl_3$ is reduced, thus detg. Fe alone.
W. T. H. (*C. A.*)

36. An apparatus for the rapid measurement of surface tension. R. G. GREEN. *J. Bact.*, **7**, 367–70(1922).—An app. called the surface tension balance is described for the rapid measurement of surface tension by the drop-weight method. It consists of a dropping pipet, a delicate torsion balance, and an adjustable scale upon which the surface tension is read directly in dynes per cm. JOHN T. MYERS (*C. A.*)

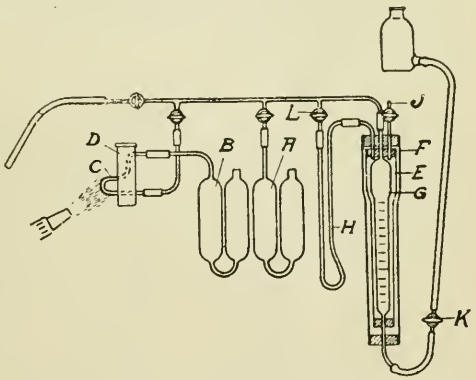
37. New stalagmometer or guttameter. F. ESCHBAUM. *Ber. pharm. Ges.*, **31**, 211–9(1921).—In estimating the surface tension of liquids by the drop method, the rate of outflow must not exceed 14 to 16 drops per min., a condition usually attained by providing the instrument with a sufficient length of capillary tubing. The same result is more readily secured by the following device. The upper end of the stalagmometer or guttameter consists of a glass stopcock having an opening on one side, the barrel of which has grooves running parallel to its length and communicating with each other at both top and bottom. A portion of the surface remains smooth so that the stopcock may be completely closed. On turning the barrel, the air in passing to the top of the liquid can be directed through any desired length of capillary, thus regulating the

outflow of liquid accurately. The paper includes tables for calcg. guttameter estns. to stalagmometer measurements, and for normalizing any guttameter readings. In corrections for temp., every increase of 1° in the atm. temp. the drop wt. (guttameter) decreases by 0.25%, while the drop number (stalagmometer) increases by 0.25%.
W. O. E. (*C. A.*)

38. The origin of gumbotil. G. F. Kay and J. N. Pearce. *J. Geol.*, **28**, 89–125 (1920).—The aim of this paper has been to show by field and lab. evidence that the gumbotils on Nebraskan, Kansan, and Illinoisan glacial tills are the results of chem. weathering of the drift and furnish good criteria for differentiating the older drifts. It is recognized that wind action, freezing and thawing, burrowing of animals and slope wash have also contributed to their formation. W. F. Hunt (*C. A.*)

39. Some colloidal properties of Pleistocene clays and their bearing on the chemical theory of the formation of gumbotil. J. N. Pearce and L. B. Miller. *J. Phys. Chem.*, **26**, 1–24(1922).—The authors discuss the geological and chem. evidence in support of the theory of Kay and Pearce (preceding abstract). This assumes that, following the laying down of each original drift, a long period elapsed during which chem. weathering and leaching took place; that the upper layers are the residual left by those processes. After a time diastrophic movements occurred, and erosion then developed the topography existing at the ends of the interglacial periods. L. W. Riggs (*C. A.*)

40. Modified Orsat apparatus for flue-gas analysis. O. I. Hansen. *Ingeniören*, **30**, 467–8(1921); *Chimie et industrie*, **7**, 494–5(1922).—In the course of flue-gas analyses H. found that most of the errors of the Orsat app. are due to temp. variations caused by the construction of the app. In the modified app. devized by him, the graduated buret *G* is surrounded by an air jacket *E* (contg. a little distd. water in the bottom), surrounded in turn by a water jacket *F*. *E* is connected with the manometer tube *H; J* is a tap which is used to equalize the pressure in *E* (to avoid having too great a correction for temp. and barometric pressure) and which remains closed during the analysis. The shape of the jackets *E* and *F* is similar to that of *G* instead of having a uniform diam. as in the regular Orsat.



A. P.-C. (*C. A.*)

41. Practical interpretation of automatically recorded volumetric percentages of carbon dioxide in flue gases. W. E. Appleby. *Chem. Eng. Mining Rev.*, **14**, 156–60 (1922).—A flue-gas delator (alinement chart) is developed and illustrated. By the alinement of the values representing the vol. of CO_2 in the flue gas as read from an automatic CO_2 recorder and the difference in temp. between the atmosphere and the exit gas, the heat value wasted is read directly. Louis Jordan (*C. A.*)

42. New conceptions of electrolytes. I. The degree of dissociation of acetic acid in water and in salt solutions. Erling Schreiner. *Z. anorg. allgem. Chem.*, **115**, 181–202(1921).—A theoretical paper in which formulas are derived for correcting the dissoc. const., as ordinarily detd. from cond. measurements, for the viscosity of the soln., inter-ionic force, and the activity of the water, that is, the hydration of the H-ion. The cond. of AcOH as detd. by different observers is thus corrected at 25° over the

range of diln. from 0.0005 to 2.6 normal. The law of mass action is shown to hold up to the highest concn. From potential measurements at 18° and 25° of AcOH solns. contg. NaOAc or other salts, the activity of the acetate ion and the dissoc. const. of AcOH have been calcd. Such measurements do not, as has been generally supposed, det. the H-ion concn., but the activity of the H-ions, which is associated only with the non-hydrated ions. The dissoc. consts. of AcOH calcd. thus agree well with those calcd. from the cond. measurements. Taking the activity const. of the H-ion as 0.2, that of the acetate ion is the same in NaOAc soln. and 0.3 in Na and K chloride solns. II. **The introduction of a catalysis coefficient in hydrogen-ion catalysis.** *Ibid.*, **116**, 102–16.—In catalytic reactions such as the hydrolysis of esters or the inversion of sucrose by acids, assuming complete dissoc. and that only the H-ions are active, the reaction velocity should be proportional to the concn. Actually, however, the catalytic effect at higher concns. is greater, and a similar accelerating effect is produced by the addition of neutral salts. It is shown that, by the introduction of a catalysis coeff., f_k, this extra catalytic effect can be accounted for. The new coeff. is found to be the reciprocal of the cond.-viscosity coeff., f_μ, which is the ordinary cond. coeff. corrected for the viscosity of the electrolyte. The ratio v/C, where v is the reaction velocity and C the acid concn., thus corrected to vf_μ/C, gives a very good const. in the hydrolysis of acetates by HCl alone and in presence of neutral salts, in the inversion of sucrose, and in the keto $\longrightarrow$ enol acetone transformation. The degree of dissoc. of weaker acids, such as dichloracetic or cyanoacetic acid, can be calcd. from catalysis measurements, and the results agree very closely with those calcd. from cond. measurements. J. C. S. (*C. A.*)

43. Notes on white chlorites. E. V. Shannon and E. T. Wherry. *J. Wash. Acad. Sci.*, **12**, 239–41(1922).—New analyses of white chlorites, called colerainite, sheridanite, etc., gave:

	1	2	3
SiO_2	28.10	36.70	27.78
Al_2O_3	26.20	10.38	24.30
Fe_2O_3	1.66	1.22	0.35
FeO	none	trace	1.43
CaO	trace	0.86	trace
MnO	trace	trace	none
MgO	30.36	36.44	32.71
H_2O+	14.00	13.80	13.01
H_2O-	0.56	1.06	0.06
sum	100.88	100.46	99.64
α	1.562	1.555	1.576
β	1.562	1.560	1.576
γ	1.576	1.560	1.589
2E	0°	30°	small
sign	+	—	+

1. Brinton's Quarry, Pa. 2. Nottingham, Pa. 3. Wyoming. White chlorite from Sylmar, Pa., showed the forms: 001, 010, 110, 112, 011, 043, 111, 132, 101, 134. The Pa. chlorites were formed by the action of Mg-bearing waters on albite-pegmatite.

Edw. F. Holden (*C. A.*)

44. The mechanism of the dehydration of crystalline aluminium hydroxide and of the adsorption of water by the resulting alumina. L. H. Milligan. *J. Phys. Chem.*, **26**, 247–55(1922).—Cryst. $Al(OH)_3$ prepd. by the Bayer process does not lose wt. below 145° at atm. pressure. Above this temp. decompn. sets in with loss of water until at 200° the trihydrate is completely decomposed. The porous Al_2O_3 still retains 8% water which is given up slowly as the temp. is increased, indicating that it is held by adsorption.

Intermediate hydrates between $Al(OH)_3$ and Al_2O_3 do not exist. On rehydrating the ignited Al_2O_3 in moist air at room temp. it takes up water, the amt. taken up being greater the lower the temp. of ignition. The curves obtained on drying these samples show that the cryst. $Al(OH)_3$ is not formed again, but the water taken up is adsorbed. X-ray examn. (by Hull's method) of the materials shows that the cryst. $Al(OH)_3$ is identical with the mineral gibbsite, and that the ignited Al_2O_3 has an entirely diff. structure. The X-ray pattern of the Al_2O_3 does not change as it adsorbs water.

F. L. Browne (*C. A.*)

45. A centrifugal method for preparing colloidal ferric hydroxide, aluminium hydroxide, and silicic acid. Richard Bradfield. *J. Am. Chem. Soc.*, **44**, 965–74 (1922).—Hydrosols of hydrous Fe_2O_3, Al_2O_3, and SiO_2 of unusually high purity can be prepd. by pptg. the oxides by addn. of NH_4OH to the corresponding chlorides or HCl to Na silicate, resp., and very thoroughly washing the ppts. by decantation until they begin to become colloidal. They are then suspended in water and passed through a Sharples Supercentrifuge operating at 32,500 r.p.m. The deposit is repeatedly suspended in water and centrifuged. The lower half of the contents of the bowl is then stirred up in water, giving a hydrosol, Sol A, the upper half similarly giving Sol B. The liquid discharged from the centrifuge on the fourth and subsequent washings is Sol C. Analysis of one of the Fe_2O_3 sols showed 396 g. equiv. Fe_2O_3 per g. equiv. Cl. The SiO_2 sols are free from Cl^-. The sols are very stable; even Sol A, which contains the largest particles, gave no sepn. on 20 min. centrifuging at 2000 r.p.m. On boiling the sols may be reduced almost to sirupy consistency without coagulating. When $Al_2(SO_4)_3$ is pptd. by NH_4OH the ppt. can be peptized by this method, showing that SO_4^{--} does not ppt. the sol irreversibly as heretofore supposed. SiO_2 sol free from electrolytes has $p_H = 6.5$

F. L. Browne (*C. A.*)

PATENTS

46. Treating clay. W. Feldenheimer and W. W. Plowman. Brit. 175,050, Nov. 8, 1920. Clay is deflocculated with the aid of an alkali resinate or its equiv., such as a soln. of a resin acid in one or more alkalies, the preferred reagent being a soln. of common resin in caustic alkali, alkali silicate, or alkali carbonate, or a mixt. of caustic alkali and alkali silicate. The reagent may be applied before or after passing the suspension over mica drags, and also for the deflocculation of an already purified clay. Subsequent pptn. of the clay from the suspension may be effected as described in 121,191. (Cf. *Jour. Amer. Ceram. Soc.*, **4**, 495(1921).) (*C. A.*)

47. Zinc oxide. A. Pearson. Brit. 176,588, Jan. 17, 1921. Crude ZnO contg. colored oxides of Cd and Pb is mixed with a small quantity of $ZnSO_4$ or H_2SO_4, and calcined in a muffle at a temp. not exceeding 878°, preferably 720–820°, so as to convert the Cd and Pb into white compds. The $ZnSO_4$ added should be finely divided. (*C. A.*)

Refractories and Furnaces

48. Research is tool which will improve refractories. W. A. Hull. *Brick Clay Record*, **60**, 544–5(1922).—H. states that user and consumer should know refractories; that tridymite improves silica brick; that furnace designs should be given more attention; that chrome Fe ore is a good refractory; and that special refractory oxides and silcates should be investigated. H. G. Schurecht

49. Electric furnace iron and steel. Intermittent and alternating operations. W. E. Cahill. *Trans. Am. Electrochem. Soc.*, **41**, preprint, April (1922); *Iron Age*, **109**, 1277–8(1922).—Elec. furnace Fe castings have been made at Treadwell, Alaska, since 1918, where it has been found cheaper than possible with a cupola. The av. power consumption for 25 consecutive heats of iron and steel with 2-voltage control shows

a saving of 75 kw.-hr. per ton of Fe and 42 kw.-hr. per ton of steel. Cast iron was made with 784 kw.-hr. per ton, and steel with 893 kw.-hr. per ton. Intermittent operation is most severe on electrodes and roof. A good spout is of prime importance so that the furnace will drain. Cast gray iron of a uniformly fine-grained structure and low S, free from occluded gases is obtained. The removal of S depends upon the length of time the metal is held under a carbide slag. W. E. RUDER (*C. A.*)

50. Operation of the electric blast furnace. SEIGLE. *Rev. metal.*, **19**, 86–9(1922).—A discussion of the effect of rapid changes in temp. upon the compn. of the gas in the mouth of the furnace and the quality of the melt due to the resulting equil. between coke and ore, with special reference to the method of charging and the descent of material in the furnace. W. A. MUDGE (*C. A.*)

51. Cost of heat-treated parts reduced to a minimum by electric furnace. C. L. IPSEN. *Elec. World*, **79**, 1125–6(1922).—Detailed cost figures and comparative figures for oil furnace are given. C. G. F. (*C. A.*)

52. An adaptable electric steel company. S. G. KOON. *Iron Age*, **109**, 1196–1202 (1922).—A description of the melting, heat-treating and forging equipment of the Sizer Steel Co.'s plants at Buffalo and Syracuse. Two 12-ton Heroult furnaces, each making 4 heats per day, receive power from Niagara. All other heating is done with pulverized coal. Crank shafts, connecting rods, die blocks, stern and rudder frames, balls, rod and bars are produced. Illus. of equipment and layout are given. W. E. R. (*C. A.*)

53. Electric tool steel melting practice. W. J. GREEN AND S. S. GREEN. *Iron Age*, **109**, 999–1001(1922); cf. *C. A.* **16**, 23, 686.—The major aspects of (*a*) acid *vs.* basic bottom, (*b*) liquid *vs.* cold charge, and (*c*) double *vs.* single voltage are discussed. The basic bottom is preferred, not on account of refining the charge, but because of its ability to carry a strongly reducing slag, atm. and general melting practice. Cold charges are preferred, as open-hearth metal, impoverished by its melting conditions, can not be fully rejuvenated by ordinary elec. furnace methods. Crucible quality may only be obtained by melting high-grade cold charges. Double voltage of 115–125 high to 75–85 low is satisfactory. Higher voltages are at present satisfactory only for medium or cheaper products. A single voltage of 95 is a satisfactory all-round pressure, in life of refractory, output and quality of product. W. E. RUDER (*C. A.*)

54. The Fiat electric furnace. ANON. *Engineering*, **113**, 421–2(1922).—About 50 Italian firms now have elec. furnace equipment. There are about 100 small furnaces of about 1 ton which work only a few mos. during the year. In northern Italy there are now 22 15-ton Heroult furnaces and 10 of 5–8 ton capacity. The Fiat furnace has been in constant operation for the last 5 yrs. There are now four 20-ton and 12 smaller (3–6 ton) furnaces in operation at the Fiat plants. The furnace is cylindrical in shape, 3-phase type, with the hearth slightly conductive and connected to ground. A characteristic feature is the "economizer" or electrode holder which completely encloses the furnace roof. This is a water-cooled cylinder, fitted with insulating rings to guide the electrode, and prevents their wasting. The design provides for ease of access for maintenance. The sides of the electrodes remain parallel and carry greater current down inside the furnace, thus reducing the working time. The electrode consumption is 6.3 lb. per ton of steel. The av. power required is 650 kw. hrs. per ton. Roof and linings last about 150 heats, and clamps have not needed renewal in 5 years. It has been possible to reach 9 heats per 24 hrs. starting from a cold charge.

W. E. RUDER (*C. A.*)

55. Electric furnace melting. H. NEEDHAM. *Chem. Met. Eng.*, **26**, 871(1922).—The selection of the correct elec. system is the secret of the com. success of an elec. furnace. The elec. furnace depends not upon any cleansing action so much as upon the

absence of contaminating impurities. Modern furnaces are fitted with tight doors, electrode economizers and flame muffling devices, which makes them very highly efficient. The use of small or large amts. of Al is purely a question of skilled metallurgy.

W. E. R. (*C. A.*)

56. Melts aluminium in electric furnace. H. E. Diller. *Foundry*, **50**, 345–51 (1922).—A description of an elec. installation and a comparison of results with crucible and elec. furnaces. The furnace consists of a large steel shell on trunnions and swung by a hand wheel. The body and cover are lined with insulating material and fire-clay brick. Two electrodes are connected with resistance formed of small particles of C held in a carborundum trough, which extends completely around the furnace at the height indicated by the electrodes. The heat is reflected to the roof and down upon the metal. The metal is charged through a door in the rear and is rabbled during the melting operation through a rear door. The bath is fluxed with cryolite. The hand ladles used are preheated. It requires 728 kw. to melt 1 ton (909 kg.); this high figure is due to the heat of fusion of Al. The principal expense in the crucible process lies in the crucibles and in the elec. furnace. The expense is due to high installation and current costs. The latter costs are not increasing as rapidly as fuel costs and melt losses are about $^1/_4$ those of the crucible process. Other advantages of the elec. furnace include: absence of fume and smoke, little lining repair, lower heat radiation and better working conditions. *Heats of fusion* in B. t. u. are given as: Al, 139; Zn, 58; Sn, 25.

W. H. Boynton (*C. A.*)

57. The melting of cast iron in the Booth rotating electric furnace. H. M. Williams and T. B. Terry. *Trans. Am. Electrochem. Soc.*, **41**, preprint, Apr. (1922).—Results of research with a small (250 lb.) elec. furnace are described. 750 heats have been made, and the furnace is now making 15 heats per week. Satisfactory castings have been made from boiler-plate, ferro-silicon and C; malleable from borings and steel; and iron alloys of various kinds. Refining by slagging is not possible with this type of furnace.

W. E. Ruder (*C. A.*)

58. Electric furnace melting. W. H. Keen. *Chem. Met. Eng.*, **26**, 869–70(1922).—Elec. furnace processes should be compared with the open-hearth and not the crucible process, though the product may resemble that of the latter. For this reason an open-hearth melter is usually better adapted to elec. furnace operation than a crucible melter. It is quite possible to make high-grade steel from poor scrap in the elec. furnace, but it is usually not advisable from a cost viewpoint. Al should not be used to correct improper working, but a little should be added, to insure complete deoxidation.

W. E. Ruder (*C. A.*)

59. An explanatory note on heat insulating materials. Max Jakob. *Arch. Warmewirtschaft*, **3**, 23–6(1922).—An explanatory discussion of an article by Hencky and Cammerer, *Mitt. Forschungsheim für Warmeschutz*, Nos. 1 and 2. Contrary to H. and C. the only comparable method of expressing value of an insulating material is its heat transmission coeff. Tables are given showing that the fall in temp. or the total amt. of heat lost per hour depends on so many variables that they can not be used as a comparison of insulating materials. The paper contains a number of references to articles on heat-insulating materials.

W. L. Badger (*C. A.*)

60. (Blast furnace) lining failures caused by zinc. P. O. Menke. *Iron Trade Rev.*, **70**, 1409–10(1922); cf. *Ceram. Abs.*, **1**, 181(1922).—Investigations of several disintegrated blast furnace linings showed the presence of varying amts. from 0.1 to 40% of ZnO absorbed in the body of the brick. It is often present in the ores and limestones from certain regions. It is assumed that it had combined with the alumina in the brick. Its effect, which is accumulative, is to expand and break up the bond. Water-cooling above the mantle seems to accelerate the action. By using a heavy shell, if

necessary above 1-in. thick, and removing the water-cooling above the mantle, the trouble can be reduced to a min. J. L. WILEY (*C. A.*)

61. Cast iron as produced in the electric furnace and some of its problems. G. K. ELLIOTT. *Trans. Am. Electrochem. Soc.*, **41**, preprint (1922); *Iron Age*, **109**, 1225–6. —The history of the development of the elec. furnace for the prepn. of cast Fe is outlined. The refining on a basic bottom of cupola-melted metal is the field of widest possibilities for the elec. furnace for cast Fe. Ability to refine in addition to melting and increased power to superheat are 2 desirable characteristics lacking in the cupola but outstanding in the elec. furnace. Elimination of S is the most striking reaction in the basic elec. furnace. Anomalous results have been reported as to the effects of S on irons. Low S may be simply an indication that the iron has passed through a strong refining treatment and better quality in such a case may be due to elimination of little known impurities, as O or N. One of the moot questions of cast Fe is whether or not Fe oxide can exist in molten cast Fe in the presence of the usual amt. of C, Si, and Mn and, if it is present, whether its influence is harmful or beneficial. The question of O in cast Fe, as well as that of N and other gaseous elements, must remain unsettled until satisfactory analytical methods are available. The superheating possible in the elec. furnace is of advantage in producing fluidity with any compn. of Fe. There is evidence that elimination of CO and CO_2 in cast Fe has a retarding effect on the pptn. of graphite. This factor may contribute to the increased strength and soundness of elec.-furnace cast Fe. LOUIS JORDAN (*C. A.*)

62. Chromite in 1921. EDWARD SAMPSON. U. S. Geol. Survey, *Mineral Resources of U. S., 1921*, Pt. I, 15–17 (Preprint No. 3, publ. May 15, 1922). E. J. C. (*C. A.*)

63. Recovery of radiated heat from a rotary kiln or drier. ANON. *Chem. Met. Eng.*, **26**, 846(1922).—The kiln is to be surrounded by an insulated housing. Air is to be drawn through the annular space and thus preheated before being used in firing the kiln. The radiation from an uncovered kiln may be as high as 1000 B. t. u. per sq. ft. per hr. Insulation within the kiln is not practical because of the high temp. of the refractories which would result. W. L. BADGER (*C. A.*)

64. Electromagnetic motions in electric furnaces. CARL HERRING. *Trans. Am. Electrochem. Soc.*, **41**, preprint (1922); cf. *C. A.*, **15**, 1857; *J. Franklin Inst.*, **192**, 599(1921).—It is the purpose of the present paper to show how the new law proposed in the former paper may be applied in practice to the production of possible forces for performing desired useful operations, like circulating, stirring, transferring, etc., in elec. furnaces. Guides are given to aid in detg. whether such motions can probably be produced by the current. The former restrictions to only one such motion-producing force were not justified, and many others formerly not accepted are possible. D. MACRAE (*C. A.*)

PATENTS

65. Refractory compositions. BUFFALO REFRACTORY CORPORATION. Brit. 176,436, Nov. 2, 1920. A refractory compn. comprizes Si carbide, flake or cryst. graphite, a flux, and a carbonizing binder, such as tar or molasses. As fluxes, clay, salts, such as borax, metallic or non-metallic oxides, or sulfides may be used. The mixt. is molded in the usual manner and baked at about 1000°. Suitable proportions of the ingredients are 68 pts. of Si carbide, 25 pts. of graphite, and 7 pts. of flux, or of flux and binder. The compn. is suitable for making heat-resisting articles such as crucibles, fire bricks, retorts, muffles, furnace cores, tubes, combustion boats, pyrometer tubes, furnace linings, and heat-resisting cements. (*C. A.*)

66. Refractory compositions. BUFFALO REFRACTORY CORPORATION. Brit. 176,437, Nov. 2, 1920. A refractory compn. for making heat-resisting articles, such as

crucibles, comprises a refractory elec.-furnace product such as fused alumina or silica, flake or cryst. graphite, a flux, and a carbonizing binder such as tar or molasses. As fluxes, clay, salts such as borax, metallic or non-metallic oxides, or sulfides may be used. The mixt. is molded in the usual manner and baked at about 1000°. Suitable proportions of the ingredients are 60 pts. of the elec.-furnace product, 20 pts. of graphite, 12 pts. of binder, and 8 pts. of flux. Cf. preceding pat. (*C. A.*)

67. Preserving electric-furnace linings. H. C. Sicard. U. S. 1,416,584, May 16. A lining contg. Ti oxide is used in smelting mixts. contg. Ti ores and other ores such as Fe oxide or Fe and C. (*C. A.*)

68. Refractory composition. H. H. Buckman and G. A. Pritchard. U. S. 1,412,916, Apr. 18. A material adapted for making retorts, muffles or crucibles is formed of zircon and a refractory clay. Cf. *Ceram. Abs.*, **1**, 68(1922). (*C. A.*)

Abrasives

69. Abrasives. Anon. *Min. & Eng. Record*, **26**, 253(1922).—This year abrasives have been produced in B. C. for the first time. A shipment of quartz has been made from the Drum Lummon Mine to Victoria to be used in the manufacture of sand paper. O. P. R. Ogilvie

70. Garnet. Raymond B. Ladoo. U. S. Bur. of Mines, *Repts. of Investigations*, No. **2347**, 16 pp.(1922).—This paper gives a general description of garnets, their geological occurrence, localities (N. Y., N. H., N. C., Conn., Pa., Ga., Va., Spain, Labrador), statistics as to production (from 1910–18, U. S. production was four to six thousand tons/yr., the value increased from 113 to 248 thousand dollars, N. Y. being the largest producer), methods of mining and milling tests, uses (abrasives) and a bibliography. Edw. F. Holden (*C. A.*)

PATENTS

71. Metallic carbides. S. Goldstein. Brit. 175,638, Feb. 16, 1922. Artificial stones for making drilling and turning tools and wire-drawing dies are produced by mixing powd. W, Mo, or like difficultly fusible metal with diamond dust, and heating the mixt. in a closed mold in an elec. arc or resistance furnace. The product is a carbide which may contain excess C in the form of diamond particles, particularly in the center of the mass. Other metals such as Fe and Ti may be added to the mixt. before heating. (*C. A.*)

72. Artificial corundum. H. A. Richmond and R. MacDonald, Jr. U. S. 1,413,785, Apr. 25. Impure Al_2O_3 is melted, a portion of the Si and Fe oxides is reduced by C in an elec. furnace (without materially reducing the Ti oxide which is present to not more than 0.6%) and the mass is allowed to cool. (*C. A.*)

Stoneware, Whiteware and Porcelain

73. The influence of fuels containing sulfur on lead glazes. Anon. *Keram. Rundschau*, **30**, 280(1922).—Sulfureous gases only affect the glazes when the fumes come in contact with the ware. If the draft is good this does not occur in a muffle or semi-muffle kiln, but when the draft is sluggish these fumes permeate through the muffle and combine with the glazes causing a dull gloss. When using a semi-muffle kiln the ware should be protected by means of slabs, so placed as to prevent the gases from coming in direct contact with the ware. Firing with a reducing atm. after the glaze has commenced to melt will prevent dull glazes. H. G. Schurecht

74. Artificial teeth. Anon. *Keram. Rundschau*, **30**, 280(1922).—The bodies are rich in feldspar and are fired to cones 5–7. TiO_2 and Fe_2O_3 are added for color. H. G. S.

75. **Collophane, a much neglected mineral.** A. F. Rogers. *Am. J. Sci.*, **3**, 269–76 (1922).—Collophane is amorphous Ca "carbophosphate," usually massive, sometimes oölitic, sp. gr. 2.6 to 2.9, varying with its porosity and compn.; the hardness varies from 3 to 5, and n from 1.57 to 1.63. Collophane is the main constituent of *phosphate rock*. Analyses of 4 foreign specimens are recorded, also one from Crawford Mts., Utah, which gave: CaO 50.97, MgO 0.22, Fe_2O_3 + Al_2O_3 0.76, Na_2O 2.00, K_2O 0.47, SiO_2 0.30, P_2O_5 36.35, CO_2 1.72, F_2 0.40, SO_4 2.98, H_2O 1.05, insol. 1.82, sum 99.04%. The mineral may be regarded as a solid soln. of CaF_2, $CaSO_4$, $CaCO_3$ and CaO in $Ca_3(PO_4)_2$. Like most other amorphous minerals it is of colloidal origin and contains an indefinite amt. of water. Formula: $3Ca_3(PO_4)_2.nCa(CO_3, F_2, SO_4, O).(H_2O)_x$, where n is an indefinite number varying from 1 to 2. The carbonate radical usually predominates over the other minor constituents. L. W. Riggs (*C. A.*)

BOOK

76. **Meissner Porzellan.** Doenges, Willy. 2nd Ed. Dresden: Wolfgang Jess. 236 pp. M 75, bound M 95. Reviewed in *Tonind. Z.*, **45**, 1257(1921). (*C. A.*)

PATENTS

77. **Filter press with a rotary filter.** R. D. Lucas. U. S. 1,415,461, May 9. (*C. A.*)

78. **Potter's clay.** R. L. Cawood. U. S. 1,414,254, Apr. 25. A potter's clay having the properties of true kaolin is prepd. by subjecting a natural mixt. of partially and wholly kaolinized feldspar to comminution in H_2O and removing mica and excess H_2O. (*C. A.*)

Art and Design

79. **Black porcelain glazes.** Anon. *Keram. Rundschau*, **30**, 280(1922).—Two kgs. of coloring oxide are used to 50 kgs. of glaze. The following coloring oxides are usually employed: U_3O_8, CoO and Mn_2O_3. H. G. S.

80. **A comparative study of methods used for the measurement of color.** T. Martin Lowry and L. P. McHatton. *J. Oil Colour Chemists' Assoc.*, **4**, 189–204 (1921). F. A. Wertz (*C. A.*)

81. **Color measurement.** Heinrich Trillich. *Farben-Ztg.*, **27**, 1721–3, 1794–8, 1874–6, 2017–22(1922).—A criticism of Ostwald's system of color designation (*C. A.*, **14**, 492) and a suggested modification of his color circle. F. A. Wertz (*C. A.*)

82. **Theory and practise in color measuring and recording.** A. E. Bawtree. *J. Oil Colour Chemists' Assoc.*, **4**, 165–88(1921).—A discussion of the system of designating colors as described by Lawrence (*C. A.*, **13**, 1643) and their measurement according to this system with the Bawtree colorimeter (*C. A.*, **15**, 2). F. A. Wertz (*C. A.*)

83. **Color circles.** W. H. Thomas. *Textile Colorist*, **44**, 241–2(1922).—Describes a circle system of shading which shows the shade produced by mixing any 2 colors, and its comparative brightness. Chas E. Mullin (*C. A.*)

Heavy Clay Products

84. **Durability of cement drain tile and concrete in alkali soils: Third progress report (1919–20).** G. M. Williams. *Bur. Standards, Tech. Papers*, No. **214**.—The third progress report on the investigation of the durability of cement drain tile and concrete exposed to alkali soils and waters gives an account of the condition in 1919 and 1920 of exptl. drains laid in western alkali districts in 1913, and of large concrete blocks similarly exposed in 1915. Both drain tile and concrete blocks were made up in sufficient quantity and variety to be representative of all qualities, and were installed in typical alkali sections of the arid belt from New Mexico to Montana. With reference to drain

tile the following tentative conclusions have been drawn: (1) The use of cement drain tile in soils where sulphates occur in considerable quantities is hazardous. In certain localities the best quality of tile disintegrated within six years. (2) Porous or permeable tile, made from lean or dry mixts., are subject to disintegration in sulphate waters of relatively low concn. (3) Disintegration of mortar or concrete in sulphate waters may be due in part to physical forces arising from crystn. of salts in the pores, but it is primarily due to chem. attack upon the cement. (4) In the best quality of tile the outer skin may sometimes remain apparently unaffected, at the same time allowing the alkali water to pass through and attack the mass underneath. (5) In tile of given quality exposed to sulphate waters, the disintegrating effect seems to vary with the concn. (6) Tile made by hand or with the packer-head type of machine, and of sufficiently dry consistency to permit immediate removal of the molds, are less resistant to alkali action than tile of a wetter consistency which requires their retention in the molds for a period of hours. (7) Tile cured with steam seem to be no more resistant to alkali attack than those cured by systematic sprinkling. Tar and cement grout coatings were not effective in protecting the tile. (8) If cement drain tile are to be used in soils or waters containing more than 0.1% of sulphates, careful consideration should be given to sub-surface conditions, the quality of tile to be used, etc. (9) Quality of cement drain tile can best be measured by permeability tests. There appears to be little definite relation between permeability and the related factors of porosity, absorption, and density. With regard to concrete the following tentative conclusions have been drawn: (1) Materials of good quality and proper workmanship are of great importance in the fabrication of concrete exposed to alkali soils and waters. (2) Surface action on concrete blocks of good quality after 1 year's exposure has in most cases been progressive. (3) The extent and rapidity of disintegration depends upon concentration of soluble sulphates. (4) Disintegration of concrete blocks containing reinforcing rods has in some cases been aided by corrosion of the rods and consequent splitting of the concrete. (5) Concrete structures exposed to alkali waters should be given all possible protection by drainage. (6) Concrete of the best quality will disintegrate if exposed to sufficiently high concns. of alkali, such as were encountered in some of the locations where the test blocks were installed. (7) So far as the tests indicate, the resistance to alkali action of mass concrete, made of the same aggregates and exposed to the same concns., varies with the cement content or richness of mix. This again seems to indicate that strength and permeability, rather than absorption, are the governing factors in determining the quality and durability of concrete under alkali exposure. This paper carries two appendixes, one containing a summary of the absorption tests on samples of all types of drain tile used in the investigation, and the other a discussion of the occurrence of sol. salts in the soil and their action on cement and concrete. H. F. S.

85. Manufacture of sewer pipe. ANON. *Keram. Rundschau*, **30**, 301(1922).—The firing of sewer pipe can be done most economically in coupled kilns, whereby the hot gases pass through at least 3 kilns and the heat from the cooling kilns is utilized in the heating up the newly set ware. In this manner the heat is more thoroughly utilized and about 50% of the fuel is saved over that used by the periodic system.

H. G. SCHURECHT

86. Increasing kiln volume without more kilns. ANON. *Brick and Clay Record*, **61**, 102–5(1922).—The Minter flue system is described. This system permits continuous burning in periodic kilns, saves fuel and speeds up burning. This system will work on practically any plant with moderate changes. H. G. SCHURECHT

87. The dielectric anomalies of silica glass. A. JAQUEROD AND H. MUGELI. *Arch. sci. phys. nat.*, **4**, 10–26(1922).—An introductory sketch of theories of dielectrics. Exptl. results are promised later. E. D. WILLIAMSON (*C. A.*)

88. **Clay pipe pronounced equal to cast iron pipe.** S. E. Dibble. *Brick and Clay Record*, **61**, 34(1922).—D. established (1) that a proper bituminous compound can be used efficiently in jointing a clay pipe; (2) that joints made in this manner developed will stand any pressure that the pipe is capable of standing, without leaking; (3) that a pipe line so jointed can be thrown out of alignment without causing a leakage at the joints, and (4) that leaks due to poor workmanship can be repaired easily and quickly.

H. G. Schurecht

89. **Manganese for improving quality.** Anon. *Brick and Clay Record*, **61**, 32–33(1922).—By the use of Mn., better color can often be produced in brick; light burn and buff brick can be made into beautiful French gray shades; remarkable and unusual speckled effects can be produced; red burning clay can be made to produce the very popular brown shades; and better colors can often be produced in drain tile and hollow-tile which burn to unsightly colors. H. G. Schurecht

Glass

90. **Unbreakable glass.** Anon. *So. African Jour. of Ind.*, **5**, 237(1922).—At one of the oldest glass factories in Bohemia, after many years of experiment, a glass has been produced, which is claimed to be absolutely unbreakable. Receptacles made from the material can be thrown about, made red hot, and then put into cold water, without breaking. Hammers can be made from it and it is difficult to cut it even with a diamond. It is important to note, however, that this invention can only be placed on a commercial basis when a special kind of sand is available in large quantities. At the present time it exists only in the neighborhood of Dresden and in small quantities. The original founder of the factory was an ordinary glass blower, who rose to fame by his production of chemical glass. O. P. R. Ogilvie

91. **Glasses colored with copper oxide.** Albert Granger. *Le Verre*, **2**, 73–4 (1922).—A blue glass may be obtained from the following:

$$\left.\begin{matrix}2.5\\3.0\\3.5\end{matrix}\right\}\ SiO_2\ \left\{\begin{matrix}0.05\ CuO\\0.25\ CaO\\0.70\ Na_2O \text{ or } K_2O.\end{matrix}\right.$$

Substitution of 0.25 CaO, BaO, ZnO, or PbO in the 3.5 SiO_2 formula does not cause any change in the color. In the 3.0 SiO_2 glass, 0.25 MgO developed a poor blue. Lowering the alk. and increasing the lime gives a blue-green as in 2.5 SiO_2, 0.05 CuO, 0.45 CaO, and 0.50 Na_2O or K_2O. Increase in CuO to 0.10 causes this glass to become green, further additions of CuO causing the glass to darken. In the following a green effect is noticed as the lime increases:

$$3.5\ SiO_2\ \left\{\begin{matrix}0.05\text{–}0.05\text{–}0.05\ CuO\\0.25\text{–}0.45\text{–}0.55\ CaO\\0.70\text{–}0.50\text{–}0.40\ Na_2O\end{matrix}\right.$$

A blue-green glass is obtained from an increase in the CuO:

$$3.0\ SiO_2\ \left\{\begin{matrix}0.10\text{–}0.10\text{–}0.17\ CuO\\0.20\text{–}0.40\text{–}0.41\ CaO\\0.70\text{–}0.50\text{–}0.42\ Na_2O\end{matrix}\right.$$

More acid glasses will also have a blue-green color:

$$3.5\ SiO_2\ \left\{\begin{matrix}0.05\text{–}0.10\text{–}0.25\text{–}0.25\ CuO\\0.45\text{–}0.65\text{–}0.50\text{–}0.25\ CaO\\0.50\text{–}0.25\text{–}0.25\text{–}0.50\ Na_2O \text{ or } K_2O\end{matrix}\right.$$

In the glass 3.5 SiO_2, 0.05 CuO, 0.70 CaO, 0.25 Na_2O, where the lime is much in excess, the copper is pptd. by touching the hot melt with a cold body. *Effect of alumina.*

Addition of 0.1 Al_2O_3 to 3.5 SiO_2, 0.05 CuO, 0.25 CaO, 0.70 Na_2O showed no effect.

Effect of boric anhydride. The following glasses have a very rich peacock blue tint:

$$3.0\ SiO_2 \left\{ \begin{array}{l} 0.05\text{–}0.10\ CuO \\ 0.25\text{–}0.20\ CaO \\ 0.70\text{–}0.70\ Na_2O \end{array} \right. \\ 0.5\ B_2O_3$$

On increasing the B_2O_3 content, the glasses are much darkened:

$$2.5\ SiO_2 \left\{ \begin{array}{l} 0.05\text{–}0.15\ CuO \\ 0.20\text{–}0.15\ CaO \\ 0.70\text{–}0.70\ Na_2O \end{array} \right. \\ 1.0\ B_2O_3$$

Besides the deepened color, these glasses appear green-black by reflection. The simultaneous addition of B_2O_3 and Al_2O_3 seems to give more transparency to the glass than with the B_2O_3 alone, as in:

$$\left. \begin{array}{l} 2.5\ SiO_2 \\ \\ 1.0\ B_2O_3 \end{array} \right\} 0.25\ Al_2O_3 \left\{ \begin{array}{l} 0.15\ CuO \\ 0.15\ CaO \\ 0.70\ Na_2O \end{array} \right.$$

and

$$\left. \begin{array}{l} 3.0\ SiO_2 \\ \\ 0.5\ B_2O_3 \end{array} \right\} 0.10\ Al_2O_3 \left\{ \begin{array}{l} 0.05\ CuO \\ 0.25\ CaO \\ 0\ 70\ Na_2O. \end{array} \right.$$

Effect of ferric oxide. The addition of 0.027 Fe_2O_3 to 2.5 SiO_2, 0.11 CuO, 0.36 CaO, 0.53 Na_2O gave a true green, whereas the base glass did not. LOUIS NAVIAS

92. The manufacture of reflecting surfaces. K. GUNDLACH. *Naturwissenschaften*, **10**, 117–9(1922).—A discussion of a recent symposium (*"A Discussion of the Making of Reflecting Surfaces held on Nov. 26, 1920 at the Imperial College of Science and Technology, So. Kensington,"* Fleetway Press. Holborn). The subjects are treated historically, scientifically and technically and include (1) a survey of the bibliography on metallic deposition on glass; (2) a bibliography of the important papers on the construction and nature of reflecting surfaces; (3) the formaldehyde process of silvering; (4) workshop notes on silvering; (5) silvering of glass reflectors by chem. deposition; (6) silvering of a large reflector; (7) silvering of quartz and glass fibers; (8) mirrors used for reflecting heat radiation; (9) deposition of metals by cathodic sputtering *in vacuo;* (10) production of mirrors by cathodic bombardment; (11) Pt reflecting surfaces prepd. by the burning-in process; (12) mirrors for use in optical instruments under industrial conditions and (13) a photometric method of measuring the reflecting power of mirrors.
C. C. DAVIS (*C. A.*)

93. Glass-lined tanks. G. F. KROHA. *Ungerer's Bull.*, **3**, 21–2(1922).—The gradual development of the industry, the construction of the various forms and the final coating with glass are described in considerable detail. W. O. E. (*C. A.*)

94. New recuperative pot furnace. W. R. CULBERTSON. *Glass Worker*, **41**, No. 34, 11, 29(1922).—The Chapman Stein recuperator applied to pot furnaces gives more accurate temp. control. Records from such a 14-pot furnace (each pot holding a batch of 2400 lbs.) which has been in operation in this country for nearly a year also show that from 10–15 more pots per week are obtained from this furnace with about 35% less fuel than from an adjacent regenerative furnace of the same size. J. B. P. (*C. A.*)

95. Effect of the rays from radium, X-rays, and ultraviolet rays on glass. J. R. CLARKE. *J. Soc. Glass Technology*, **5**, 155–65(1921).—A series of soda-lime glasses of the same compn., except that some contained Se, some Co oxide, and others no admixture, has been exposed to the action of α-, β- and γ-rays, β- and γ- rays, γ-rays, X-rays, and ultraviolet rays, resp. All glasses contg. Se or Co oxide were colored brown by β-rays, the depth of coloration corresponding with the range of the β-particles in the glasses. The intensity of coloration was greatest at the surface, decreased toward the interior, and in-

creased with increasing Se or Co oxide content. As the radiation was prolonged, the intensity increased to a max., which depended on the percentage of coloring agent, and then remained const. The pure soda-lime glass was only affected by α-rays, being faintly colored on the surface only. None of the glasses was affected by X-rays, γ-rays, or ultraviolet rays. All the glasses fluoresced in Ra Em, but a fatigue effect was observed at about the same time as the attainment of max. intensity of coloration. The coloration of glasses is regarded as due to the formation of colloidal particles in the glass. The presence of such particles is explained as being due to the action of α- or β-rays on ions already present in the glasses. The fluorescence is held to be due to mechanical bombardment of the glass mols. by the rays. J. C. S. (*C. A.*)

96. An autoclave test for the grading of chemical glassware. W. L. Baillie and F. E. Wilson. *J. Soc. Chem. Ind.*, **41**, 45–56T(1922).—Contains much exptl. work. Important. Can not be abstracted. G. E. Barton (*C. A.*)

PATENTS

97. Glass. W. C. Taylor. U. S. 1,414,715, May 2. A flesh-colored glass of high ultra-violet absorption and good visible transmission is formed with a content of 3–6% CeO_2 and 0.2% MnO_2, together with SiO_2, K_2O, Na_2O and CaO. Cf. *Ceram. Abs.*, **1**, 216(1922). (*C. A.*)

98. Compound glass sheets. J. Cox. Brit. 175,044, Nov. 6, 1920. In making compd. glass sheets, the surfaces are treated with a soln. composed of gum mastic, amyl acetate, pyroxylin or collodion, and ricinol oil, dissolved in abs. alc., and superposed sheets are subjected to pressure at a temp. which allows superfluous liquid to escape. When cool, the edges are treated with linseed oil, and the sheets are again heated and pressed; and the edges of the finished sheets are finally sealed with a soln. of shellac in methylated spirit. (*C. A.*)

99. Glass. H. T. Bellamy and B. T. Sweely. U. S. 1,415,980, May 16. A non-electrolytic glass suitable for use as a binder for high-resistance compns. is formed of silicates and borates of Ca and Ba. (*C. A.*)

100. Glass. Titanium Pigment Co., Inc. Brit. 176,430, Oct. 29, 1920. TiO_2, is introduced into glass batches in the ratio of not less than 25% of the whole. *E. g.*, silica 69 parts by wt., borax 10, Na_2CO_3 29, CaO 7, TiO_2 45. (*C. A.*)

Cement, Lime and Plaster

101. Analysis of gypsum in cements—quick method. C. Bertin. *Rev. Mat. Constr. Trav. Pub.*, **154**, 133(1922).—*Ordinary method.* 1–2 gm. of cement are dissolved in hydrochloric acid, and the silica removed after evapn. to dryness, by filtering the remoistened residue. The sulphur trioxide is then pptd. as barium sulphate, which is filtered off, ignited and weighed. Time, about 3 hrs. *Quick method.* 1 gm. of cement is boiled in 50–60 cc. of distilled water, containing 2 gm. of ammonium chloride for 8–10 mins. Pass the soln. through an ordinary filter, acidify the filtrate (*a*) with hydrochloric acid, and bring to a boil, add a pinch of barium chloride crystals, continue boiling for 5 mins., then let stand $^1/_2$ hr. Filter off the barium sulphate, wash, ignite and weigh. Time, about 1 hr. The ammonium chloride increases the soly. of the gypsum in the water soln., the gypsum passing into the filtrate (*a*). As a small quantity of lime is also dissolved, it is necessary to convert it to the chloride before adding the barium salt. The results of this method compare favorably with those obtained by the longer methods. Louis Navias

102. Plant of the Mozambique Portland Cement Co., Ltd., at Lourenco Marques. Anon. *Jour. Chem. Met. & Min. Soc. of So. Africa*, **22**, 203(1922).—The Portland cement factory of the Mozambique Cement Co. will have an output of 700 tons of Port-

land cement per week. The method of manuf. is upon the wet process. The raw materials are brought to the factory by barge, where they will be unloaded upon a jetty and transferred to the factory. The limestone is fed to jaw crushers, 1,000 mm. by 500 mm., after which it passes through crushing rolls. This reduces the limestone to approx. walnut size. It is then elevated into a hopper over a compd. ball and tube mill, 11 m. long and 1.8 m. in diameter. The clay, when delivered to the factory, is first dealt with in a wash-mill, after which it is pumped into the compound ball and tube mill and ground with the limestone. Water is introduced into the grinding mill, and the limestone and clay are ground together in the wet state (about 40% of water) to a fineness of about 10% on 180-mesh sieve. The "slurry," as it is termed, coming from the compd. ball and tube mill is elevated into one of three mixers, where it is thoroughly mixed and proportioned. One mixer is of sufficient capacity to enable the kiln to run over the week-end without refilling. The slurry transport and agitation is carried out in a special manner. Hitherto, slurry has been pumped by plunger or centrifugal pumps, and agitated mechanically. In this factory, however, completely new methods are introduced, and the slurry is elevated by means of pressers and is agitated in the tank by means of blasts of compressed air. When found to be of correct proportions for calcining, the mixing tank is sealed and is used for the supply of the kiln. The kiln itself is 56 m. long and 2,800 to 2,300 mm. in diameter. The plates in the firing zone are approx. $^7/_8$ in. in thickness, and the kiln is furnished with four cast-steel rollers and a cast-iron rim for the drive. The cooler is attached to the kiln in prolongation. This attachment permits of several advantages, notably, only one motor to drive, instead of two where the cooler is separate; much lower foundations; absence of stairs, gangways, etc., and perfect accessibility and easy attendance. Furthermore, no movable kiln head is required; and a considerable saving through the utilization of heat radiated from the material passing through the cooling section is effected. Coal is supplied to the kiln in the following manner: When delivered to the factory by trucks run in on the company's siding, the coal is first crushed and thoroughly dried in a rotary drier. It is then passed through a small compound ball and tube mill, 8 m. in length and 1.4 m. in diameter. It is then elevated into a storage hopper, from which it is wormed into the coal feed pipe through which a continuous blast of air passes by means of a high-pressure fan. The clinker coming from the cooler is taken on a shaker conveyor to the boot of an elevator, which elevates on to another conveyor running over the whole length of the clinker store. Sufficient storage has been allowed for four weeks' out-put at the rate of 1,400 T. per week (the factory is so designed as to permit of duplication in the near future). The clinker is reclaimed by a conveyor running underneath the clinker store house, and after the gypsum has been added is elevated over a compound ball and tube mill for clinker grinding. The cement is ground to a fineness of 8–10 per cent on 180-mesh sieve, and is wormed and elevated into the cement store, where automatic sack-packing machines have been provided. (*So. African Eng.*, February, 1922 (A. K.).) O. P. R. OGILVIE

103. Tests on mortars and concrete immersed in sea water for 15 years. E. CANDOLT. *Rev. Mat. Constr. Trav. Pub.*, **153**, 105–6(1922).—Results of test pieces made at Haïphong, Indo-China. Large blocks were cemented onto the rocks, so that they were completely covered at high tide and uncovered at low tide by the sea water for 15 yrs. Cement N° 1, used for sea construction work had the following properties:— % chem. comp., SiO_2 22.20, Al_2O_3 6.85, Fe_2O_3 2.00, CaO 66.05, MgO 0.25, SO_3 0.50, ignition loss 2.15, apparent d. 1.228, time of set 4 hours, tensile strength in Kgs. per sq. cm. on pure cement, after 7 days, 34.0, 28 days 45.0, $2^1/_2$ years 57.7, on 1:3 plastic mortar, after 7 days 12.0, 28 days 15.0, $2^1/_2$ years 34.0. Cement N° 3 (not intended for sea construction work), % chem. compn., SiO_2 21.65, Al_2O_3 6.90, Fe_2O_3 1.95, CaO 64.75, MgO 0.30, SO_3 0.60. Ignition loss 3.85, apparent d. 1.182, time of set 3 hrs. 10 mins.,

tensile strength, on pure cement, after 7 days 37.9, 28 days 50.5, $2^1/_2$ yrs. 59.2, on 1:3 plastic mortar, after 7 days 19.2, 28 days 26.5, $2^1/_2$ yrs. 32.3. Compression tests were made on cubes of 10 cm. side, cut from the large pieces after 15 years' immersion. Results given are for the average of 6 tests for each mixt., in Kg. per sq. cm. Mortars. To 1 cubic meter of sand, 250 Kg. Cement N° 1, 213.33 Kg. per sq. cm. 450 Kg. Cement N° 1, 323.5, 650 Kg. Cement N° 1, 504.16, 450 Kg. Cement N° 3, 480.8, 650 Kg. Cement N° 3, 697.5, 1,000 Kg. Cement N° 3, 710.83. Concrete. 450 Kg. Cement N° 3, 1 cubic meter sand, 1.5 cubic meters pebbles, 336.66, 1.000 Kg. Cement N° 1, 1 cubic meter sand, 2 cubic meters pebbles, 492.5. LOUIS NAVIAS

BOOK REVIEWS

A valuable addition has been made to the library of ceramic publications. This is the "1922 Clay Products Cyclopedia," published by Industrial Publications, Inc., 407 South Dearborn Street, Chicago, Ill. The book consists of two main parts, the first information on definitions and statistics, and the second, catalog pages of the manufacturers of equipment. The definitions cover 117 pages and describe 752 processes, materials and pieces of equipment. These definitions are amply illustrated. The statistical section covers 75 pages, arranged and indexed for instantaneous reference. This section is valuable in order to save the time of an executive in searching for the necessary data.

An original index is one called the Departmental Index of Plant Equipment. In this index are listed the numbers of all items that are used in or concern each department. The numbers of the items refer to the definitions. In this way the reader can easily find all related topics, and determine through the definitions the one best adapted to the use he has in mind.

The catalog section contains informative data regarding the equipment and materials manufactured by the different firms supplying the industry.

The value of the Cyclopedia lies in the fact that it combines in one book information which the clay products manufacturer would otherwise be compelled to search for in various catalogs, reference and technical books.

This book is published by the same organization that publishes *Brick and Clay Record.* The combination gives to the clay products manufacturer all possible information that he requires. The periodical treats of current topics, new developments, improvements, trade matters, and association and convention items. The Cyclopedia, being a year book, furnishes all necessary information for reference use bound in one volume.

This book is being received with great interest throughout the industry.

F. A. GUIGNON

Proposed Scientific Journal

The preliminary issue of the *Journal of Scientific Instruments* has been received and will prove of exceptional interest to the readers of this *Journal.* An introductory article in the *Journal* explains the importance of issuing a British Journal of this type but unless sufficient subscribers are obtained the publication will be discontinued. The *Journal* is a monthly publication dealing with the principles, construction and use of instruments. The contents of the preliminary number together with the list of articles in prospect give promise that the *Journal* will occupy a position of importance among the scientific journals. Among the articles listed are the following: "The

Scheme for a Journal of Scientific Instruments" by E. H. Raynor; "Instruments and Apparatus in Relation to Progress in Physiology" by A. V. Hill; "The Use of a Reference Plate for the Micrometric Measurement of Astronomical Photographs" by Sir Frank Dyson; "The New Fundamental Bench Mark of the Ordnance Surveys" by Sir Charles Close; "The Optical Sonometer" by F. Twyman and J. H. Dowell; "Two Machines for Rapidly Weighing Loads of a Few Milligrams" by The Research Staff of the General Electric Co., Ltd., London; "Reid Control Indicator for Aeroplanes" by Dr. J. Robinson; "The Measurement of the Internal Diameters of Transparent Tubes" by John S. Anderson, and a number of others. Copious advertising in this issue has enabled the editor to obtain the best of paper and printing and the cuts are many and good. The *Journal* is published by the Institute of Physics, London, with E. H. Raynor as acting editor.

Official Personnel of Divisions 1922–23

	Art	Enamel	Glass	H. Clay Prod.	Refractories	Terra Cotta	White Wares
Chairman	F. H. Rhead	B. T. Sweely	J. C. Hostetter	C. F. Tefft	J. Spotts McDowell	A. F. Hottinger	F. K. Pence
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CERAMIC ABSTRACTS

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General and Miscellaneous

1. The influence of small amounts of electrolytes on stability of clay suspensions and their use in purification of clay. H. Kohl. *Ber. der Deut. Keram. Gesellschaft*, **3**, Pt. 2, 64–77(1922).—The stabilizing effect of Na_2CO_3 and Na_2SiO_3 on suspensions of clay, quartz, mica, pyrites, and iron oxides was investigated. All these materials in fine suspension in dil. alk. soln. are negatively charged and on electrolysis are deposited at the anode; hence it is not possible to purify a clay by the electrosmosis process, which merely acts as a filter. The impurities in clay are pptd. at lower concn. of alk. than kaolin, and can be partially removed by a correct regulation of the alk. concn. in the settling tank. It is possible to stabilize a clay free from polyvalent salts with much less alk. than is needed when such salts, as $CaSO_4$, etc., are present. The viscosity of a clay slip was found to reach a min. with 0.3% Na_2CO_3, while it had a max. stability with 0.83%. The adsorption of ions by kaolin was measured by adding it to solns. of Na_2CO_3 and Na_2SiO_3 and detg. the cond. in an ordinary Bunsen cond. cell. The cond. decreased nearly proportionate to the amt. of kaolin added. The stabilizing effect of alk. at low concn. is attributed to the mutual repulsion of the neg. charged particles. As the concn. of the alk. exceeds the max. stabilizing value, the coagulating influence of the cation begins to predominate. E. N. Bunting

2. Benefits of technical and scientific research. Ross C. Purdy. *Glass Worker*, **41**, No. 47, 11(1922).—Address before the Window Glass Manufacturers Ass'n. R. J. Montgomery

3. New uses for clay. Anon. *London Times Trade Supp.*, **10**, 374(1922).—Describes uses of clay: (1) In the manuf. of rubber, (2) rubber latex, a new material for water-proofing paper and linoleum. China clay and rubber may be utilized as road surface material possessing a high resistance and dust-combating qualities. Describes expts. made to increase hard-wearing qualities of rubber by addition of mineral substances to obviate the tedious series of cures for each mixing, by using a base mix contg. rubber, 100 pts. (by wt.), litharge, 30 pts., sulphur, 5 pts. Stress-strain curves were obtained. China clay vies with zinc oxide as reinforcing agent, although the breaking tension is less well maintained. The toughening effect of various pig-

ments was arrived at by a consideration of conditions governing abrasive wear, as in automobile thread. The object was to increase the energy absorption of rubber to lessen stressing the rubber substance past its rupture point. Barytes continuously diminished the energy content while china clay increased it. China-clay producers are keenly interested in expts. with road-surface materials since the substance counteracts the stress on the rubber that causes rupture. O. P. R. O.

4. Canadian institute of chemistry. H. J. Roost. *Can. Chem. & Met.*, **6**, 128.—The report of the Secretary shows the institute to have progressed favorably in its organization and to be now ready to enter upon the work for which it was created, that is "To raise the profession of Chemistry to its proper position among the other learned professions" and "To look after and promote the professional well-being and interests of Chemists" and to assist in the development of the Dominion of Canada.

O. P. R. Ogilvie

5. Technical excursion in the north and in Belgium. Anon. *Céramique*, **25**, 193–7, 241–51(1922).—The French Society of Ceram. Manufs. took an excursion through N. France and Belgium and visited a large number of ceramic plants.

H. G. Schurecht

6. German glass society. Anon. *Keram. Rundschau*, **30**, 325(1922).—On July 9, a meeting was held for the purpose of organizing a German Glass Society. Their address is Frankfurt a. M. Gutleutstrasse. H. G. Schurecht

7. Plant of the Huron Clay Products Co. Anon. *Clayworker*, **78**, 148–9(1922).—The brick and tile plant at Croswell, Mich., is described, in which the Boss system of drying and burning is employed. H. G. Schurecht

8. The third annual meeting of the German Ceramic Society. Anon. *Keram. Rundschau*, **30**, 309–11, 318–20, 325–7(1922).—At this meeting the following papers were given: (1) Fine stoneware, by W. Pukall; (2) Study of porcelain with low firing temps., by W. Funk; (3) The testing of ceramic bodies for artificial teeth, by H. Eisenlohr; (4) The use of geology in ceramics, by W. Braun; (5) The ceram. industry of U. S., by K. Endell; (6) The influence of typical fire clays on the behavior of refractory bodies at high temps., by W. Steger; (7) The coeff. of expans. and several other physical properties of whiteware and its dependence upon the compn. and firing temp., by H. Kohl; (8) The influence of compn. of porcelain upon its properties by R. Rieke; (9) Construction in the ceram. industry, by U. Sauer. (Abstracts of the above papers are given.) H. G. Schurecht

9. CO_2 in flue gas when burning oil. Anon. *Brick & Clay Record*, **61**, 259 (1922).—An error in interpreting the CO_2 content in flue gas when burning oil is likely to arise among engineers who have been familiar with coal burning. This comes from the fact that perfect combustion of coal would give a higher CO_2 reading than perfect combustion of oil. The explanation of this lies in the greater amount of H in the oil. The H requires O for its combustion and this in turn brings N which appears in the flue gas. The H does not produce CO_2 and the water vapor that it does produce does not appear in the flue gas analysis. The result is that the higher the H content in the fuel the lower the theoretical per cent CO_2 in the flue gas. H. G. Schurecht

10. Report of experiments on producer-gas. K. Morimoto. *J. Jap. Cer. Assoc.*, **341**, 149–51; **342**, 187, 192; **343**, 230–3(1921).—At window-glass works of the Asahi Glass Co., producer-gas is used in hot state except a small portion. The author, noticing that the usual method of sampling gas and its quant. analysis after it is cooled did not indicate the true nature of the gas, attempted the quant. analyses of water-vapor and tarry matter besides usual constituents. The several methods failed. After many trials, a new app. was designed which has proved to be satisfactory enough for factory use. The app. consists of 4 flasks, an elec. fan and a gas-meter. Hot

gas is forced to pass successively through the flasks by the suction of fan which discharges the gas to the gas-meter. The first flask is partly filled with water or heavy oil to which the end of tube, leading hot gas, dips and has also a tin-plate cylinder filled with broken glass or beads at the end of exit tube while the other 3 are empty; the second flask has a cylinder similar to the former; the third flask is just like the second except the cylinder, which is filled with glass-wool; the last flask has a cylinder contg. absorbent cotton and a thermometer. The temp. of gas at the outlet of the last flask is kept 1–2°C higher than that of the room; the flasks are therefore cooled with water or ice. Sample is collected through a tube inserted downward into downcomer or side walls of gas-main. Now setting the fan in motion, about 10 cu. ft. of gas is taken. Water-vapor and tar, condensing in the cooler, are collected, and their amts. are detd. The compn. of the gas at the outlet of the gas-meter is detd. in usual way. In calcg. the vol. of vapors, assumptions are made that tar consists of naphthalene and also that water and tar exist in gaseous state at ordinary temps. The expts. at a factory revealed poor nature of the hot gas, therefore many improvements on the producers and their manipulation were undertaken. The following table shows the compns. of the producer-gases before and after improvements:

TABLE I

		CO_2	O_2	C_2H_4	CO	CH_4	H_2	N_2
Before impr.	Cold gas	7.28%	0.56%	0.68%	16.30%	5.20%	13.54%	56.44%
	Hot gas	5.78	0.45	0.54	12.95	4.13	10.76	44.97
After impr.	Cold gas	6.28	0.25	0.27	20.00	8.67	12.20	52.33
	Hot gas	5.72	0.23	0.25	18.20	7.90	11.10	47.66

		H_2O	$C_{10}H_8$	B.t.u. per cu. Shaku (net)	Combustion temp.	Temp. of gas
Before impr.	Cold gas	...	..	156.20	1578°C	20°C
	Hot gas	20.20	0.22	138.20	1494°	170°
After impr.	Cold gas	...	..	192.40	1606°	20°
	Hot gas	8.70	0.24	189.60	1637°	220°

The calorific power of gas increases as its water content decreases. However the water-vapor which is introduced by the moisture and combined water of coal is unavoidable, and its amt. is about 5.10% at the said factory. S. KONDO

11. The present condition of ammonia-soda industry in Japan and its future. S. NAKAHARA. *J. Jap. Cer. Assoc.*, **352**, 624–30(1921).—Descriptions on the demand of soda-ash in Japan and statistics on soda industry in foreign countries are given. The ammonia-soda plant which was established in 1917 by the Asahi Glass Co., manufacturers of window glass, has since had better experience, and is now mfg. about 10 T. of soda-ash a day. Raw materials, fuel and labor required for mfg. one T. of soda-ash in March, 1921, were as follows: 1.9 T. salt (85%), 1.5 T. limestone (98%), 1.1 T. coal (with 22% ash), 0.2 T. coke (with 29% ash), 0.014 T. ammonia and 10 workmen (8 hrs.). Cheaper supply of salt and prevention of dumping by foreign manufacturers are needed to the further development of the industry. S. KONDO

12. The plant manager and the chemist. GEO. L. O'BRIEN. *J. Ind. Eng. Chem.*, **14**, 650–1(1922). E. J. C. (*C. A.*)

13. Can the college do anything for industry? EDWARD ELLERY. *J. Ind. Eng. Chem.*, **14**, 544(1922).—The college can reduce the period of unproductiveness of their graduates when they enter industry by training them in the acquisition, recognition, application and description of facts, and finally in handling an original problem. For this purpose it is essential that there be (1) small instructional groups, (2) superior

students sepd. from inferior students, (3) strongest teachers in charge of freshmen and seniors, and (4) a limitation of the number of students and of the number of hours the good teachers teach. W. C. EBAUGH (*C. A.*)

14. The blue flame produced by common salt on a coal fire. W. HUGES. *Nature*, **109**, 683(1922).—Arguments are advanced to show that the blue flame which is seen when NaCl is thrown on a coal fire is due to CO produced by the cooling of the hot coal by the NaCl rather than to traces of Cu in the coal. ARTHUR SMITHELLS. *Ibid.*, 745.—The work of different investigators is quoted to show on the contrary that the blue color is due to $CuCl_2$, the source of the Cu being the pyrites of the coal.
W. H. ROSS (*C. A.*)

15. Crushing, storing and pulverizing. L. H. STURTEVANT. *Rock Products*, **25**, No. 3, 28–9(1922).—Almost entirely mechanical. The following topics are discussed: phosphate rock, unloading power shovels, crushing, pulverizing, air separators, dust collectors, storage, and labor requirements. E. F. PERKINS (*C. A.*)

16. Geography of electrochemistry. W. S. LANDIS. *J. Ind. Eng. Chem.*, **14**, 554–5(1922).—Hydro development possibilities of the five continents and the East Indies are discussed. The struggle for supremacy will be between the United States, Norway, India, China and Canada. W. H. BOYNTON (*C. A.*)

17. Industrial research. ANON. *Electrician*, **88**, 450(1922).—A short report on the activities of the Brit. Elec. & Allied Industries Research Assoc. Brief comments are included on micas, synthetic resins, insulating oils, turbine blades, etc.
C. G. F. (*C. A.*)

18. The future of industrial research. F. PEAKE SEXTON. *Electrician*, **88**, 627(1922).—A general discussion. "The personnel of the laboratory is the most important item." C. G. F. (*C. A.*)

19. The place of scientific research in the programs of trade associations. E. R. WEIDLEIN. *Chem. Age* (N. Y.), **30**, 241–3(1922). E. H. (*C. A.*)

PATENTS

20. Process of manufacturing liquid gold. JIRO ISHIKAWA. Japan 40,632, November 14, 1921. Sulphur-balsam is added to a soln. of gold chloride and the mixt. is heated on a water-bath. Sulphur-resin-gold, thus prepd. is washed and heated to evap. water. Then, aluminium resinate, uranium resinate and bismuth resinate are added. The product is dissolved in the mixt. of lavender and rosemary oils.
S. KONDO

21. Electrical insulation. R. E. OTTMAN. U. S. 1,418,730, June 6. A non-conducting fabric such as paper or cardboard is impregnated with a soln. of borax and NH_4 phosphate, dried and then coated with a mixt. of $CaCO_3$, ZnO and linseed oil.
(*C. A.*)

Apparatus and Instruments

22. Some of the difficulties encountered in maintaining a pyrometer installation in a works. ROBERT S. WHIPPLE. *Trans. Ceram. Soc.* (Eng.), **21**, 1–23(1922).—The pyrometer should be placed where the fireman can see the records readily. He thus soon regards it as a friend, whereas, if it is in the manager's office he thinks of it as a policeman. The following points are useful for standardizing thermocouples: Freezing point of tin, 231.8°C; of lead, 327.4°C; of zinc, 419.4°C. (The f. p. of zinc is particularly useful; detns. made on a sample continuously for 6 yrs. in one crucible gave strictly consistent results.) Boiling point of sulphur, 444.7°C; freezing point of antimony, 630.7°C; of sodium chloride, 800°C. (The f. p. of common salt (NaCl) 800°C is an extremely useful point, as small variations in the purity of the material make practically no difference.) Freezing point of silver, 960.8°C; of copper, 1083°C.

The galvanometer must be placed where it is not abnormally heated nor subject to temp. variation. If accuracy is desired, the temp. of the end of compensating leads must be controlled. The simplest way is to use a thermos flask filled with oil, the juncture of copper leads being placed near the bottom of the flask. The temp. of the surrounding air may change 20°C during 24 hrs., yet the temp. inside the flask remains const. to within 1°C. Another way is to bury the junction at a depth of 10 to 12 ft. below the floor. Works of any size should possess a potentiometer for checking the couples and galvanometers. Radiation and optical pyrometers are graduated to give the true temp. under black-body conditions. The industrial furnace practically fulfills these conditions. A closed fire clay or quartz tube (not less than 10 cms. internal diam.) built into a fur. gives almost ideal conditions. As long as the image of the hot body formed by the concave reflector is large enough to cover the small thermocouple in the pyrometer, the instalment is independent of the distance between it and the hot body. The importance of black-body conditions is greater in the case of radiation instruments. The only way to maintain a successful pyrometer installation is to make it definitely someone's business to look after the instruments. The substitution of a new porcelain or quartz sheath for a broken one will save the thermocouples and a good deal of worry. The leads and switches between the pyrometer and indicator or recorder must be kept clean and in good order. (See *Ceram. Abs.*, **1**, 199(1922).) H. F. S.

23. Pycnometer density determinations. R. Saar. *Chem.-Ztg.*, **46**, 433–5 (1922).—A series of tables, calcd. to 6 decimal places, for correcting to standard conditions densities detd. under a given set of conditions. Illustrated by problems.
W. C. Ebaugh (*C. A.*)

24. Recording calorific value of gas. The Fairweather recording calorimeter. Anon. *Gas World*, **77**, 12–13(1922).—This instrument has been provisionally prescribed by the Gas Referees for producing continuous records at the Brentford Gas Plant. This calorimeter comprizes, briefly, a water-flow calorimeter of the Boys type, adapted to record continuously the total ht. value of the gas, reduced to standard temp. and pressure. This automatic and continuous operation is effected by combining with the calorimeter proper the following automatic devices: Means for supplying to the calorimeter a definite and measured water flow; means for automatically adjusting such flow to compensate for the effect of temp. and pressure conditions of the gas; a time-controlled wet meter adapted to supply gas uniformly to the calorimeter at a const. rate; a recording thermometer adapted to indicate the temp. rise imparted to the water passing through the calorimeter. This temp. rise is a direct measure of the calorific value of the gas and is converted into B. t. u. by appropriate ruling of the record sheet. Details are given by reference to a diagram. J. L. Wiley (*C. A.*)

25. An apparatus for handling deliquescent crystals. C. B. Slawson. *Am. Mineral.*, **7**, 25–6(1922).—The crystals are handled in a galvanized-Fe box with glass windows at top and front, the arms of the operator entering through rubber sleeves at either end. E. T. Wherry (*C. A.*)

26. Two machines for rapidly weighing loads of a few milligrams. Research Staff of The General Electric Co., Ltd., London (E. M. and C. G. Eden). *J. Sci. Instruments*, Prelim. No. **1922**, 15–21.—The two machines described were designed for sorting elec.-lamp filaments to an accuracy within 5% of their wt. A cantilever spring is used in the first machine and the motion of its end is magnified by optical projection 30 times. The scale (0 to 40 mg.) is 13 cm. long. The second machine consists of a small weighing beam controlled by a hair spring. Mechanical magnification between 10 and 100 times is obtained by a fine wire tension lever connecting to a wire hanging in a catenary under its own wt. The movement of the catenary wire is magnified optically 30 to 50 times. Curves showing sensitivity of balance, and effect

of stiffness of controlling spring and catenary are given. The speed of each balance is about 400 filaments per hr. D. E. S. (*C. A.*)

27. The thermel. W. P. White. *Science*, **55**, 617–8(1922).—The classical names, thermocouple and thermopile, are awkward when applied to temp.-measuring instruments, which frequently include both at once, and where the mere number of parts is usually a secondary matter. A single term for all such instruments is desirable. The term "thermoelectric thermometer" is logical, but unnecessarily long; "thermoelement" is not logical, and its use has caused considerable confusion. The term "thermel," which is merely an abbreviation of "thermoelectric thermometer," is logical, short and definite, has met with general informal approval, and is urged as a desirable general term for all thermoelec. temp.-measuring devices. "Thermocouple" and "multiple thermel" (or "thermopile") may still be used in the few cases where it is desirable to call attention to the special construction of the thermel. W. P. White (*C. A.*)

28. Union gas calorimeter. Axel Danielson. *Teknisk. Tidskrift*, **52**, 313–4 (1922).—A modification of Strach's calorimeter, designed by O. Dommer, Karlsruhe, was tried out in a Stockholm gas plant. It is a very serviceable instrument. It gave caloric values which averaged 2% less than the Junker calorimeter.

A. R. Rose (*C. A.*)

29. Röntgenographic determination of crystal arrangement. M. Polanyi. *Naturwissenschaften*, **10**, 411–6(1922).—Röntgenographic methods must be employed to det. whether a crystal lattice is changed by elongation of a single crystal. By means of a filament diagram it was found that for a Zn crystal (1) the lattice changes its orientation with respect to the longitudinal axis when elongated; (2) in the section drawn out to a flat band (cf. Schiebold, *Z. Physik*, **9**, 180(1922); Carpenter and Elam, *C. A.*, **16**, 1728; Gomperz, *C. A.*, **16**, 1387) the angle that the hexagonal axis of the crystal lattice makes with the longitudinal axis changes from 10° to 18° and (3) the cylindrical filaments resulting from further elongation of the flat bands have the same orientation of their lattices as the flat bands. It is maintained that this same kind of shift in the orientation of the lattice occurs in a Zn wire as in the individual crystal. A bibliography is appended. C. C. Davis (*C. A.*)

30. Total-radiation pyrometer. Eberhard Zopf. *Z. Ver. deut. Ing.*, **65**, 1267 (1921).—Brief description of the Siemens and Halske so-called Ardometer.

W. P. White (*C. A.*)

PATENTS

31. Brick-hacking machine. William H. Allen. U. S. 1,414,998, May 2, 1922. In a hacking device for bricks and the like, the combination of means for feeding a plurality of bricks in succession, a turntable, a transfer car carried thereby adjacent the delivery end of said brick feeding means, and means for moving the turntable parallel to the direction of movement of the bricks in the brick-feeding means.

C. M. S., Jr.

32. Lens-grinding machine. Leon G. Simpson. U. S. 1,415,613, May 9, 1922. The combination of a lens carrier and a grinding tool coöperating therewith, one of the parts having a recess on the side thereof opposite the other of the parts, a guide bar and a universal joint between the recessed part and bar comprising a bearing member within the recess and rounded on the bottom for pivotal movement in the recess and a pin pivotally connecting the bearing member and guide bar within and adjacent the bottom of the recess. C. M. S., Jr.

33. Apparatus for reactions at high temperatures under pressure. A. T. Stuart and G. N. Middleton. U. S. 1,417,585, May 30. The app. is adapted for *cracking hydroçarbons*. It comprizes a closed reaction chamber the wall of which is of a material

having a high elec. resistance by which it may be heated by elec. current to the desired reaction temp. The reaction chamber is surrounded by reinforcing material to support its wall against internal pressure. (*C. A.*)

34. Electrical precipitation of suspended particles from gases. E. R. Wolcott U. S. 1,416,769, May 23. Before pptn. by the action of an a. c., gases such as cement kiln or smelter gases are humidified to facilitate the pptn. of suspended particles from them. (*C. A.*)

Chemistry, Physics and Geology

35. The chemical composition of a rock known as the kaolin from Djebel Debar (Algeria). Albert Granger and Pierre Brémond. *Comptes Rendus*, **175**, 36–8 (1922).—The material is white and contains no mica and no quartz impurities; will not disintegrate after months of immersion in water. When crushed and well mixed with water, a sticky mass is obtained which seems to contain 2 constituents, (1) a hard inert material, (2) the material which is miscible with water. For porcelain it is ground with water in a ball mill. The chem. compn. is SiO_2 34.99, Al_2O_3 34.65, Fe_2O_3 0.22, CaO 0.55, MgO 0.04, K_2O 0.83, Na_2O 0.31, ignition loss 28.19. The Al_2O_3 content and the ignition loss are higher than for kaolins. It is much more easily attacked by acids than is kaolinite. Louis Navias

36. Chemical composition of alkalic feldspar. K. Seto. *J. Jap. Cer. Assoc.*, **343**, 237–40; **344**, 269–71(1921).—Hitherto published analyses of feldspars do not agree well with their optical consts., probably owing to the difference in samples. To make up the deficiency, the same crystals whose optical properties had been detd. by Prof. Kozu of the Tohôku Imperial University were analyzed as accurately as possible. The samples include albite of Alp Rishuna, orthoclase of Madagascar, moonstone of Ceylon, adularia of St. Gothard, same of Riedertobel and a native perthite. The composition of the perthite which is produced at Kutsuwatori, near Ishikawa, Fukushimaken, is as follows: 65.44% silica, 19.55% alumina, 0.05% ferric oxide, 0.12% magnesia, 0.49% lime, 3.77% soda, 10.78% potash, 0.18% loss on ignition and 100.38% in total. Mineral compn. of the perthite is, therefore, $Or_{63.8}Ab_{33.7}An_{2.5}$. The mineral is used in potteries. S. Kondo

37. The action of heat on refractory clays; and their rational analyses. K. Fuha. *J. Jap. Cer. Assoc.*, **351**, 566–98(1921).—The study was carried out with the object of getting full knowledge on clays used in the manuf. of pots for optical glass. The soly. of 6 clays in boiling conc. hydrochloric acid, and analyses of the solns. and residues are described. Soly. ranged 23–75% when boiled for $1^1/_2$ hrs., and 93–96% on boiling for 24 hrs. Lime and magnesia were almost completely dissolved. The loss on heating at various temps. is described. The temps. at which the wt. of Japanese clays decreases most rapidly are 400–500 °C. The soly. of 7 clays, previously heated at various temps., in boiling hydrochloric acid is discussed. The result, in short, confirms that of A. N. Sokoloff in 1912. The methods of rational analysis and its published discussions are described. Clay, heated up to 800 °C may be used for rational analysis; there were wonderful differences in the amts. of residues between clays, heated at 1000° or 1100°, and those heated at 1200°. This increase is due to those of alumina and silica, their ratio in equivalents being about 1:2. S. Kondo

38. Clays of the Mount Hongo in Fukushima prefecture. K. Hojo. *J. Jap. Cer. Assoc.*, **355**, 98–105(1922).—Hongo is one of the chief porcelain producing districts in Japan, the products being known as Aizu ware. Clays of the Mt. Hongo are chief body materials of the Aizu porcelain; they are decomposed liparite. Clays of the best quality have compns. as follows:

Name of clay	Ignition loss	SiO_2	Al_2O_3	Fe_2O_3	MnO	CaO	MgO	P_2O_5	Na_2O	K_2O
Jari.....	4.34	78.50	13.16	0.46	0.52	1.29	0.26	..	0.97	0.81
Okubo.....	5.14	71.43	17.83	0.55	..	1.87	0.79	0.46	1.27	0.90

S. KONDO

39. The ceramic materials in Saga prefecture. K. IHARA. *J. Jap. Cer. Assoc.*, **353**, 3–15(1922).—A detailed geological survey of the districts producing raw materials of pottery is given. Izumiyama which was found about 300 years ago by S. Li and since has been used as the chief raw material of famous Arita porcelain is a decomposed liparite. The liparite is composed of fine-grained feldspar and quartz, the former being kaolinized markedly; it has sometimes minute iron pyrites and is silicified in part by fine veins of chalcedony. The presence of alum in some of the cleavages and the strong smell of sulphur in the mine indicate that the decompn. of its feldspar has been caused by the actions of sulphurous gas and hot spring. It is classified to 4 kinds; the best one has a compn. of 3.12% loss on ignition, 76.07% silica, 14.11% alumina, 0.88% ferric oxide, 1.97% lime, traces of manganous oxide and magnesia, 0.15% titanium dioxide, 2.67% potash and 1.36% soda. Some other liparites have probably been decomposed by weathering. S. KONDO

40. Report on clay resources for Soma wares. S. NÔTOMI. *Geological Survey, Bull.* **67**.—Geology of the region surrounding the village of Obori where the Soma stone-ware are manufd. is described. The clayey stratum of the region has probably formed by the deposition of weathered gneiss and granitic sandstone and is composed of granitic sand and kaolin. It contains also remarkable propn. of peat. S. KONDO

41. Feldspar deposits of the Ottawa District. N. B. DAVIS. *Can. Min. Jour.*, **43**, 521(1922).—Mr. Davis gives history of the deposits, and the work done on development of same; the character of the feldspar; its analyses; the method of its mining; and illustrations of the quarries and pits. O. P. R. O.

42. Barium in Canada. H. S. SPENCE. *Rept. Mines Branch*, Dept. of Mines, Canada, 1922.—This rept. gives history of baryte mining in Canada: occurrences and character of Canadian barytes; describes methods of mining and milling; gives analyses, production, exports and imports; includes the production of barytes in other countries; gives principal consumers in the U. S.; gives a general outline of process through which crude barytes pass in the prepn. of ground barytes for the trade. O. P. R. O.

43. Pottery clays in Canada. J. KEELE. *Mineral Resources of Canada*, Mines Branch, Dept. of Mines, Canada, 1922.—Describes the different types of pottery and the clays required by each. Glacial lake and estuarine clays widely distributed throughout Canada are used for the manuf. of common brick and drain tile; not suitable for pottery in their natural state. Stoneware clays are sparingly distributed in Canada and are accessible for present use in Nova Scotia and Saskatchewan only. No ball clays are found in Canada, except among the white clays of Saskatchewan. The only white burning kaolin found in Canada is in Quebec. The only known deposits of stoneware and fire clay occur in Ontario, but beyond the reach of transportation. Saskatchewan is the only region in Canada where valuable clays occur in abundance, suitable for various kinds of pottery. O. P. R. O.

44. Strontium in Canada. H. S. SPENCE. Mines Branch, Dept. of Mines, Canada, 1922.—Two commercial sources of strontium are celestite (Strontium sulphate), and strontianite (strontium carbonate). Celestite is by far the more common and most largely used in the production of strontium salts. Four occurrences of celestite of economic importance are known, all of them in Ontario. Celestite is white, cream-colored or bluish and occurs in tabular crystals, and in aggregates of fibrous or columnar crystals. Its hardness is 3 to 3.5, being lighter than barytes; sp. gr. is 3.9. Pure celestite contains 56.4% strontia and 43.6% sulphur trioxide. It is readily distinguished

from barytes by flame test. The chief sources of the world's supply of celestite are England and Sicily. Strontianite is more valuable since it is readily sol. in acids. Weight for wt., it contains 70.3% strontia but most strontianites have a portion of their strontia replaced by lime. Strontianite commands a higher market price than celestite and is a relatively rare mineral occurring in economic quantities very rarely. Prussia is the most important source; occurs as a gangue mineral in Germany and Scotland; found in California in the form of irregular masses of clay. The chief use of strontium is as strontium hydrate in the beet sugar industry; also used to make "red fire" signal flares; also for medicine. Strontium carbonate is used in iridescent glass and for hardening copper castings. Celestite has been employed as substitute for barytes as a filler and in the manuf. of lithopone. O. P. R. O.

45. Process for the extraction of alumina and its salts from clay. H. G. WILDMAN. *Quarry, Surv. and Contractors' Jour.*, **27**, 233(1922).—The clay, preferably china clay, is boiled in alk. soln. made of boiling soda ash with an insufficient quantity of lime to convert all the carbonate to hydrate, 30 lbs. soda to 100 lbs. clay. The liquid is drawn off after settling and sodium carbonate and sodium hydrate added, after which the soln. is again ready for use. The clay is agitated in cold water and treated with sulphur dioxide from burning pyrites or sulphur under pressure until all absorption ceases. The mixt. is filter-pressed, obtaining pptd. silica and the filtrate passed into a second digester fitted with closed steam coils and a vacuum pump. On heating, the higher sulphides of aluminium are decomposed, giving up the sulphur dioxide in soln., the gas is removed by the pump and recovered. The aluminium is pptd. and ignited to recover the sulphur dioxide. O. P. R. O.

46. The surface tension of colloidal solutions. HEDWIG SCHLEIFFER. *Kolloid Z.*, **30**, 273–8(1922).—The surface tension at different temps. was detd. for a number of colloidal solns. in H_2O. Azobenzene, myristic acid, mastic and gum arabic were found to lower the surface tension of the dispersion medium but gamboge and hydrous Al_2O_3 did not affect it. The temp. coeff. of the colloids was almost identical with that of H_2O. Investigation showed that neither the viscosity nor the vapor tension of H_2O was changed by the presence of the suspended particles, indicating that little or no soln. took place. HARRY B. WEISER (*C. A.*)

47. Variations in the conductance of solid electrolytes. P. VAILLANT. *J. phys. radium*, **3**, 87–100(1922); cf. *C. A.*, **15**, 987.—When a solid electrolyte such as CaS is placed between metal electrodes and a voltage applied, polarization takes place and finally after some hours reaches an equil. value. If the temp. is suddenly changed the cond. undergoes 2 changes, one almost instantaneous, the other slow. The first effect is an exponential function of the abs. temp. The second effect is manifested in a series of oscillations of which the final effect is an increase or decrease in cond. depending upon whether the temp. has been lowered or raised. The increase or decrease is more rapid as the temp. change is greater. C. R. PARK (*C. A.*)

48. Capillarity. I. Some general considerations and a discussion of methods for the measurement of interfacial tension. A. FERGUSON. *Trans. Faraday Soc.*, **17**, 370–83(1922).—No data are given. Twenty methods for *measuring surface tension* are mentioned. Of these methods, capillary rise, pendant drop, or bubble, and sessile drop are mathematically analyzed. The surface tension of solids may be detd. either by change of soly. with size of particle, or change of vapor pressure with change of size of the particles considered. **II. A modification of the capillary-tube method for the measurement of surface tension.** A. FERGUSON AND P. E. DOWSON. *Ibid.*, 384–91.—The modification described consists in measuring the total pressure "p_a" above a meniscus in a capillary tube immersed in the liquid whose surface tension is to be detd. $p_a = P + g\rho h + (2T/R)$. P is the atm. pressure; ρ, the density; h, the depression

of the meniscus below the surface of the liquid; T, the surface tension; and R, the radius of curvature at the vertex of the meniscus. The surface tension of benzene was found to be 29.58 dyne-cm.$^{-1}$ at 15°. Benzene is not considered a good standard liquid, for it showed a surface tension of 29.6 dyne-cm.$^{-1}$ after careful purifying and additional crystn., and the same samples after a few days showed a surface tension of 29.9 dyne-cm.$^{-1}$ F. E. BROWN (*C. A.*)

49. Rapid tests for copper in pyrite and iron minerals. A. BRALY. *Bull. soc. franç. minéral.*, **44**, 119–21(1921).—A content of Cu as low as 0.7% is revealed by the red coloration of a $NaPO_3$ bead, heated in the reducing flame with the addition of SnO; smaller amts. by the characteristic blue flame color, obtained by roasting the powdered mineral on a mica support, adding HCl, and evapg. EDW. F. HOLDEN (*C. A.*)

50. Clays as dispersed systems. SVEN ODÉN. *Trans. Faraday Soc.*, **17**, 327–48 (1922).—No given chemical component is necessary, in order to classify a soil as a clay. A soil layer is a clay, a silt or a sand soil according to whether the greatest part falls within the limits for clay, loam, or sand. These limits are detd. by size of particles. Clays are disperse formations of mineral fragments in which particles of smaller dimensions than 2 μ predominate. Odén detd. the distribution of sizes of particles by collecting the particles settling through a tall cylinder of water on to a plate suspended near the bottom of the cylinder by a fine gold wire. The upper end of the gold wire was attached to the left pan of a balance fitted with an elec. appliance which automatically added successive equal wts. to the right pan when the accumulated sediment equalled the wts. already added. A second device recorded the time at which each wt. was added. The formula for calcg. the effective radius r of the particles is, $r = \sqrt[3]{(3/4\pi)\ (vp/sn)}$ in which v is the vol. in cm^3., p the number of g. of suspension per cm^3., s the sp. gr. (always taken as 2.7) and n, the number of particles in volume v. The method for applying this equation to a soil suspension is shown. By using suspending media having different densities and viscosities practicable rates of deposition of sediments from the finest particles up to those 50 μ in radius are possible. F. E. BROWN (*C. A.*)

51. New uses for zirconium. R. E. KIRCHNER. *Chem. Ztg.*, **46**, 380(1922).—Large deposits of zircon in South America and Mexico make this substance of potential importance. It has been used as an abrasive, in making "siloxyd" glass (superior to quartz glass because not sensitive to the action of oxides of the heavy metals), etc. ZrO_2 is the best elec. insulator at high temps., *e. g.*, 2000°. It can be used for making refractories, enamels, coloring porcelain dark violet, prepg. high-grade steels, and jackets for electric furnaces. Zr can be employed as a substitute for Pt for many purposes, especially in chem. labs. Its carbide might replace the diamond for cutting tools in the glass industry. W. C. EBAUGH (*C. A.*)

52. The solubility of small particles and the stability of colloids. L. F. KNAPP. *Trans. Faraday Soc.*, **17**, 457–65(1922).—In the presence of an excess of the substance of which the disperse phase is composed, colloidal particles are uniform in size. This is due to the fact that the soly. of particles of this size is the same as the soly. of the large undispersed body. This soly. is due to the combined effect of surface tension and the elec. charge on the surface of the particle. An equation is derived for the value of r the "critical" radius of such suspended particles. $r = \sqrt[4]{q^2d/8\pi K\sigma}$ in which q is the elec. charge on a particle, d the distance between the double elec. layers (Helmholtz), K the dielec. const. of the dispersion medium and σ the interfacial tension between the suspended particle and the dispersion medium. AgBr pptd. in gelatin forms in various small-sized particles. But after 40 min. heating the grains are uniform and larger than the largest particles first formed. To explain this increase in size one must assume either that the charging of the particle is a gradual process of adsorbing ions, or that the complete pptn. of the AgBr is delayed by the gelatin. In this case

there is no plane surface so the final size must be the size of minimum soly. The article is largely mathematical. F. E. Brown (*C. A.*)

53. Notes on the preparation of some fluorescent and phosphorescent compounds. W. S. Andrews. *Am. Mineral.*, **7**, 19–23(1922).—Detailed directions are given for prepg. in a condition such as to exhibit max. luminescence the compds. Zn_2SiO_4, $Cd_3(PO_4)_2$, $(Cd, Zn)_3(PO_4)_2$, and ZnS, all contg. Mn as a necessary impurity; pure $Cd(OH)(PO_4)$, $CdSO_4$ and $ZnSO_4$; and a fluoride contg. some NH_4F. E. T. Wherry (*C. A.*)

Refractories and Furnaces

54. Burning ceramic products in electrically heated furnaces. Albert Granger. *Compt. rend.*, **175**, 98–100(1922).—Pieces were burned in a platinum ribbon resistance furnace and in a granular carbon resistance fur., of lab. types. The latter was built around a horizontal clay-bonded corundum tube, 66 cm. long and 10 cm. in diam. The impure corundum was obtained from the alumino-thermal process of making metallic chromium, and was purified by treating with sulfuric and hydrochloric acids. In the platinum fur. due to the continued oxidizing conditions light-colored burned pieces were easily obtained. In the carbon resistance furnace a porcelain body turned out greyish, a condition that is met with in commercial kilns when the atm. is too reducing. The grey color would then be explained as being due to the occlusion by the glaze of finely divided carbon, which has not been burned and is being carried by the flame. In the present case there was no flame to carry the carbon. The corundum tube, however, was porous enough to allow gases to pass through. Carbon monoxide passed through the cylinder, and burned at the mouth of the tube when opened to the air. By allowing a good draft to pass through the tube the trouble from darkening of the pieces was obviated. It is assumed that the carbon which colored the porcelain in the carbon resistance furnace came from the deposition of carbon from the decompn. of the gas: $2CO = CO_2 + C$. Louis Navias

55. Refractory cements and protective coatings. C. E. Bales. *Clayworker*, **78**, 140(1922).—B. discusses the effect of substances most commonly added to fire clay and their effect. Common salt, sand, cement, water glass, lime, and asbestos decrease the refractoriness of fire clays while fire clay grog increases the refractoriness. Carborundum dust mixed to a pasty consistency with water, makes a very good protective coating but it does not add a great deal to the life of the refractory. H. G. Schurecht

56. Eleven year oil burning experience. M. Taylor. *Brick & Clay Record*, **61**, 246–7(1922).—The Vincent Clay Products Co., drain tile manufs. of Ft. Dodge, Ia., operate an 18-chamber Goldner patent kiln of the Youngren type. Each chamber is fired from the top through a series of 11 fire holes. These are spaced $3\frac{1}{2}$ ft. apart along the side of the chamber, and the flame impinges on brick fire boxes which are built into the flash wall. Only 2 firemen are necessary; there are no unsightly piles of coal or ashes and the ware is free from scum. Before making a change from coal to oil it is well to consider the following items: (1) A careful comparison of the actual operating costs of fuel oil *versus* coal, as estimated for the particular locality in question, (2) the advantages in favor of oil that can not be estd. in money, such as, clean yards, no coal or ashes, increased quality, better satisfied and more efficient burners, (3) a decision should be made as to whether the high pressure or low pressure air system would give best results and (4) the cost of installation. Formulas for fuel comparison:

$$\text{For coal } C = \frac{A}{2000\,B}$$

$$\text{For fuel oil} = \frac{D}{E\,F\,G}$$

A = Cost of a ton of coal delivered at the point of use
B = B.t.u. per lb. of coal
C = Av. cost of each B.t.u. in the coal
D = Cost of a bbl. of fuel oil delivered at the point of use
E = B.t.u. per lb. of oil
F = No. of lbs. of oil to the gal.
G = No. gals. to the bbl.
H = Av. cost of each B.t.u. of oil

In comparing the costs for any two fuels the costs of operation and the investment must be taken into account in addition to the difference in fuel value. The av. efficiency of coal is 60% and that of fuel oil is 70% and this must be taken into consideration.
H. G. SCHURECHT

57. An oil gas compensating tunnel kiln. ANON. *Brit. Clayworker* (1922); *Céramique*, **25**, 198–9(1922).—A tunnel kiln with two tunnels side by side is described. The cars run in opposite directions in each of the tunnels and in this manner the waste heat is better utilized. H. G. SCHURECHT

58. Knacks in setting up-draft kilns. E. PETTS. *Brick & Clay Record*, **61**, 211–42 (1922).—Detailed directions are given on setting and firing up-draft kilns.
H. G. SCHURECHT

59. Resistance tests on refractory products under load at different temperatures. V. BODIN. *Trans. Ceram. Soc.* (Eng.), **21**, 56–65(1921–22).—See *Jour. Amer. Ceram. Soc.*, **4**, 69(1921). H. F. S.

60. Notes on American practice in refractories. W. J. REES. F. I. C. *Trans. Ceram. Soc.* (Eng.), **21**, 69–88.—An excellent general description, laying emphasis on efficient plant lay-out and the use of labor-saving machinery. H. F. S.

61. Load tests on refractory bodies at high temperatures. E. SIEURIN, F. CARLSSON AND B. KJELLGREN. *Ber. der. Deut. Keram. Gesellschaft*, **3**, Pt. 2, 53–64(1922).—The softening temp. under press. of a fire-clay body mixed with varying amts. of SiO_2, Al_2O_3, Fe_2O_3, CaO and MgO, were detd. in a carbon resistance furnace. The clay had a soft. temp. of 1280°C and a m. p. of 1750° C. Small additions of Fe_2O_3, CaO and MgO lowered the soft. pt. rapidly. When the SiO_2 content was increased, a min. soft. pt. was reached between 60–70% SiO_2, although the lowest m. p. was at 90% SiO_2. With Al_2O_3 the max. soft. pt. was at 80% Al_2O_3. Seven graphs are given to show the effect of the added materials upon both the soft. pt. and m. p. The soft. pt. of good SiO_2 brick is 1650°C and of carborundum brick, 1800°C, the soft. pt. being taken when a linear shrinkage of 0.3% results under a press. of 2 kg./cm^2. E. N. BUNTING

62. On tunnel kilns. S. MOMOKI. *J. Jap. Cer. Assoc.*, **347**, 385–91(1921).—Although small tunnel kilns have been used for over-glaze coloring more than 10 years in Japan, Mr. K. Okura, president of the Toyo-Toki Co., was the pioneer in adopting large tunnel kiln for hard firing. In August, 1920, a Dressler tunnel kiln was completed at their factory. The result of seven-months' expt. was quite satisfactory. As to the saving in fuel, 315 lbs. of second-class lump coal of Kyushu were required for heating one car load of sanitary ware, measuring 70 cu. ft., to cone 6, while 6-m. round kilns of English style consumed 875 lbs. of the same coal in firing the equal vol. of saggers to the same temp. Conclusions are (1) that the building cost of a tunnel kiln is about 3 times as much as round kilns of same capacity, (2) that the kiln house for round kilns costs 2 times as much, for faience, and $2^1/_2$ times as much for porcelain as tunnel kiln, (3) round kilns require about double space, compared with tunnel kiln, for faience, whereas the ratio is just reversed in porcelain works and (4) also that the excess of fixed capital in the erection of tunnel kiln is cancelled by its general advantages, and accordingly it reduces the cost of production by the saving in fuel and the utilization of waste heat. S. KONDO

63. **Investigation of refractory materials; the after-contraction test.** D. A. JONES. *Quarry, Surv. and Contractors' Jour.*, 27–143(1922).—A preliminary rept. of work carried out under the auspices of the Joint Refractory Materials Committee of the Institution of Gas Engineers and the Society of British Gas Industries. Tests were made on the whole brick instead of smaller pieces. Two measurements were taken along the length, two along the width of the brick face, and the mean of each pair of readings taken. The temp. was raised over a period of 4 hrs., maintained at cone 14 for fire brick and cone 12 for silica brick; for a further period of 2 hrs. they are heated in a combustion fur. oxidizing atm. The chief source of error due to dislocation of surface of brick is that the calipers measure not only the change in length but also this indefinite surface change.
O. P. R. O.

64. **Report of the Refractory Materials Research Committee.** A. E. BROADBERRY. *Gas World*, **76**, 553–9; *Gas J.*, **158**, 840–52(1922); cf. *C. A.* **15**, 3377.—Reference is made to the need for improvement of the after-contraction or expansion test as found in the Gas Institution's standard specification for refractory materials of Nov. 1912. In regard to the retort specification (cf. *C. A.* **14**, 2411), it had originally been intended to make the retorts only from fire clay with admixture of grog, but it was now necessary to add Si and siliceous materials, aluminous materials, carborundum, etc., as well as mixts. of them. A new definition of what constitutes *signs of fusion* was suggested as being that condition "when the angular edges of the test piece begin to lose their angularity when heated under conditions stated." The contraction test had also proved difficult to carry out, the size specified being too large (4.5 in. sq.). It was now proposed to use smaller test pieces (3.5 x 1.5 to 2 x 1.5 to 2) and to place them vertically instead of horizontally. An endeavor is being made to overcome the difficulty experienced in taking the necessary measurements by allowing a tolerance of 1% for exptl. errors, but the actual allowance for contraction or expansion has been reduced from 1.25% to 1%. **Standardization of the after-contraction test.** D. A. JONES. *Gas World*, **76**, 554; *Gas. J.*, **158**, 840–4; cf. *C. A.* **16**, 808. **Thermal conductivity of refractory materials at high temperatures.** A. T. GREEN. *Gas World*, **76**, 554–8; **77**, No. 1980 (Coking Sec.), 13–18; *Gas J.*, **158**, 844–51.—The report is unsuitable for abstracting; the results being expressed mostly in tabular form. Previous work on the subject is reviewed. As regards the relationship between porosity and thermal cond., results of the expts. suggest that at high temps. (1400–1500°) some of the pore spaces lose their insulating properties, and even at 1100° have the capacity for transmitting heat at rates comparable with the solid matter. Diffusivity is indicated as being the measure of the rate of rise of temp. produced in a material. It varies with temp. in a manner similar to that of thermal cond., and in carbonizing its measurement would form a satisfactory criterion of the thermal efficiency of the material, while in furnace work where insulation is desirable, the measurement of thermal cond. would be more satisfactory.
J. L. WILEY (*C. A.*)

65. **Electric steel plant at the Southern Pacific shops.** L. J. BARTON. *Chem. Met. Eng.*, **26**, 838–40(1922).—A steel-making plant comprizing a 6-ton Heroult elec. furnace with equipment for making ingots and castings is described. The installation of the elec. furnace was made after a careful comparison of cupolas and converters, open-hearth and elec. furnaces for working up the available scrap. The elec. furnace was selected as the most suitable on the basis of the superior quality of elec. steel, a slight advantage in cost of the finished steel, and the adaptability of the elec. furnace to a wide variety of products. The basic process was chosen since the available scrap was high in S and P on account of large quantities of wrought Fe mixed with it. Operation of the furnace follows the standard 2-slag process. Data from 2 years' continuous operation show an av. power consumption of 565 kw. hr. per ton of charge; electrode consumption

of 30 lb. of carbon or 12 of graphite per ton of product. The bottom of dead-burned magnesite is still in good condition after 2 years of const. operation. This furnace has been used in the production of rivet steel, tie plate steel, steel castings, and synthetic cast Fe. LOUIS JORDAN (*C. A.*)

PATENTS

66. Rotating kiln for burning cement. NILS WINQVIST. Sweden 1,415,970, May 16, 1922. A rotary kiln having a preparatory heating zone, and flat projections extending from the wall of the zone and leaving a free central passage in the kiln, the projections being spaced longitudinally and circumferentially of the kiln and having large surfaces parallel to the direction of rotation and presenting thin edges and open spaces to the material in the direction of rotation, thereby to prevent lifting of the material by the projections during rotation. C. M. S., JR.

67. Rotary kiln. ALEXANDER B. CARSTENS. Mexico 1,415,990, May 16, 1922. A rotary kiln having openings intermediate the ends thereof, means for normally closing the openings during substantially a complete revolution of the kiln to prevent the escape of gases therefrom, and means coöperating with the first-named means to cause a momentary opening of the same, thereby permitting material to pass through the openings into the kiln. C. M. S., JR.

68. Kiln. RICHARD K. MEADE. U. S. 1,416,657, May 16, 1922. In a kiln for burning lime or the like the combination of an upright ore chamber, a coal burning fur. at the bottom of the chamber connected to the ore chamber so the latter acts as a stack, a stoking grate in the furnace composed of rocking sections and a drop bar means for operating the stoking grate outside the fur., hopper feeding means for supplying the fuel to the grate, the bottom of the kiln and the fur. being closed normally and during stoking to prevent the admission of excess air to the kiln. C. M. S., JR.

69. Electric furnaces. V. M. SAUVAGEON. Can. 219,805, June 20, 1922. A resistance furnace heating by radiation through the crown has the space above the crown filled with a resistance material. The crown and walls of the furnace are composed of a good conductor of heat which becomes an electric conductor at high temp. See *Ceram. Abs.*, **1**, 236(1922). (*C. A.*)

70. Electric furnace adapted for refining metals. H. DE NOLLY. U. S. 1,417,303, May 23. (*C. A.*)

71. Electrode furnaces. W. DYRSSEN. Can. 219,975, June 20, 1922. The electrodes are arranged in the furnace in a common counterbalanced system, one counterbalancing another. (*C. A.*)

72. Induction furnace having uni-directional circulation. J. R. WYATT. Can. 219,098. Beneath the furnace chamber and connected therewith is a resistor channel, of restricted cross-section in one part, for molten metal, in combination with an a. c. transformer having one leg threaded through the channel. The leg is nearer the metal at the more constricted part of the channel than other parts thereof. (*C. A.*)

73. Refractory material. WM. A. FRANCE. Can. 219,609, June 13, 1922. A small amt. of molten $MgCl_2$ is mixed with burned magnesite, the mixt. is moistened, then molded and pressed into the desired shape and allowed to dry without burning. (*C. A.*)

74. Electric furnace regulator system. C. A. BODDIE. Can. 219,625, June 13, 1922. The system comprizes an adjustable electrode operated by a motor, switches for controlling the direction of rotation of the motor, a main control electromagnet operated in accordance with the current passing through the furnace for selectively operating the switches and means controlled by the switches for directly varying the energization of the main control magnet in accordance with the switch operated. (*C. A.*)

75. Electric furnace regulator systems. C. A. BODDIE. Can. 219,624, June 13,

1922. The system has an electromagnet controlled in accordance with the current of the arc and a second magnet controlled in accordance with the voltage across the arc, both magnets coöperating to govern the same contact members which govern reversing switches for an electrode motor. The reversing switches govern elements for varying the energization of the electromagnets in order to prevent hunting action. Means are also provided for establishing a dynamic braking circuit for the electrode motor. (*C. A.*)

76. Abrasive and refractory articles. A. H. Anderson. Can. 219,646, June 13, 1922. A compn. for forming ceramic articles contains refractory or abrasive cryst. grains, a plastic clay, water and an oily lubricating agent. Cf. *Jour. Amer. Ceram. Soc.*, **4**, 241(1921).

77. Tilting electric furnace. W. Dyrssen. U. S. 1,416,699, May 23. (*C. A.*)

78. Refractory composition. C. A. French. U. S. 1,418,372, June 6. Zr oxide and steatite are used together to form a compn. adapted for crucibles, furnace linings or spark plug insulators. (*C. A.*)

79. Refractory material. R. W. Hull. U. S. 1,418,648, June 6. A refractory material adapted for lining furnaces is formed of the residue remaining from the concn. of Cr ore contg. a mixt. of SiO_2, serpentine and olivine, united by a binder such as pitch, tar or Al_2O_3. (*C. A.*)

BOOK

80. The electric furnace in the iron foundry. Lyman C. Judson and Harry P. Martin. *Trans. Am. Electrochem. Soc.*, **41**, advance copy (1922).—A bibliography, briefly abstracting each reference. Louis Jordan (*C. A.*)

Stoneware, White Ware and Porcelain

81. The firing of porcelain in tunnel- and round-kilns. E. Reutlinger. *Ber. der Deut. Keram. Gesellschaft*, **3**, Pt. 3, 121–46(1922).—From exhaustive expts. the best firing curves have been developed, showing the course of the temp. and the analysis of the flue gases. The present practice of many burners, to keep all parts of the kiln at the same temp., or to produce a reducing atmosphere, causes a waste of fuel either through too large an excess of air or of unburned gases. By using the recommended firing schedules a good burn with respect to fuel consumption, time of burn, and yield is obtained. The necessary measuring instruments must be installed and the burner taught to use them. The use of control methods does not necessitate a radical change in the usual practice, but allows the burner to know at all times the condition of the kiln. Although the expense of control instruments is fairly large it is justified by the saving in fuel, better yields, and independence from experienced burners. E. N. Bunting

82. The transparency of porcelain. W. Steger. *Ber. der Deut. Keram. Gesellschaft*, **3**, Pt. 2, 50–3(1922).—The influence of sand, quartz, and geyserite upon the transparency of porcelain was detd. A body contg. 30% Norwegian quartz, 40% kaolin, 30% feldspar, burned to cone 15, is 3 times as transparent as a similar body contg. Hohenbockaer sand or Taunus geyserite. When the kaolin content is 50%, feldspar 25%, Nor. quartz 25%, the transparency is twice that of a similar body contg. the sand, and 4 times that contg. the geyserite. E. N. Bunting

83. Chromatics and its application to painting porcelain. W. Funk. *Ber. der Deut. Keram. Gesellschaft*, **3**, Pt. 2, 77–86(1922).—This is an address delivered before a meeting of the Ger. Ceram. Soc. in which the author defends the esthetics of color, developed by Ostwald, as applied to the decoration of porcelain. See *Jour. Amer. Ceram. Soc.*, **4**, 247(1921). Normal colors and harmony of colors. W. Ostwald. *Ibid.*, 4, 780(1922). Fundamentals of theory of color measurement. W. Ostwald. E. N. Bunting

84. The latest literature on the "lead question." P. Bartel. *Ber der Deut. Keram. Gesellschaft*, **3**, Pt. 2, 86–108(1922).—The literature later than 1912 concerning lead compds. is reviewed under the headings (1) Laws and regulations. (2) Transactions and discussions in meetings, congresses, and parliaments. (3) Hygienics (publications of physicians, etc.). (4) Technical (research and practical expts. with lead glazes). E. N. Bunting

85. Zirconium fluoride glazes. F. Kraze. *Ber. der Deut. Keram. Gesellschaft*, **3**, Pt. 3, 157–61(1922).—The following formulae give good turbid white glazes maturing at cone 05a, applicable to either porous pot ware or iron ware:

(1)	0.735 Na_2O		3.007 SiO_2	(2)	0.728 Na_2O		
	0.214 K_2O	0.234 Al_2O_3			0.234 K_2O	0.301 Al_2O_3	3.161 SiO_2
	0.051 BaO		0.184 ZrF_4		0.029 BaO	0.035 Al_2F_6	0.061 ZrF_4

The frit must be kept molten until all SiF_4 escapes. Before grinding the frit, 0.020 kaolin is added to (1) and 0.058 to (2). Raw materials used are quartz, soda, potash feldspar, barium peroxide, sodium fluosilicate, cryolite, and zirconium silicate. E. N. Bunting

86. On the ratio of Al_2O_3 and SiO_2 to RO in porcelain glazes, fired at high temperatures. Y. Kitamura. *J. Ind. Chem. Tokio*, **2**, 89–102(1921).—The research was carried out with a view to study the effect of the variation in the ratio of alumina and silica to bases on the physical properties of hard porcelain glazes and therefrom to find the best ratios for various temps. The range of compn. of glaze was RO, 0.2–2.2 Al_2O_3, 4–26 SiO_2, where RO is 0.5 KNaO, 0.5 CaO in one series and 0.1 KNaO, 0.9 CaO in the other. Glaze was applied on 3 different biscuit bodies and burned to cones 11, 14 and 17. The results are shown with 6 diagrams, plotting alumina as ordinate and silica as abscissa. Conclusions: (1) The area within which glazes have marketable lustre and also the area wherein glazes are undermatured but have at least a slight lustre are elliptic. (2) The lustre-area expands as firing temp. rises; at the same time, the centre moves in the opposite direction to the origin of axes. (3) Glaze at the centre of lustre-area is probably the best one. Thus, the compns. of the best glazes have been calcd.

Table I

Chemical Formulas of the Best Glazes

Firing temp. (Seger cone)	RO = 0.5 KNaO, 0.5 CaO	RO = 0.1 KNaO, 0.9 CaO
11	RO, $0.9Al_2O_3$, $8SiO_2$	RO, $0.7Al_2O_3$, $6.0SiO_2$
14	RO, $1.05Al_2O_3$, $10SiO_2$	RO, $0.95Al_2O_3$, $9.5SiO_2$
17	RO, $1.1Al_2O_3$, $15SiO_2$	RO, $1.1Al_2O_3$, $14.5SiO_2$

(4) Extending the result, glazes for intermediate temps. and other different RO can be calcd. Two examples are given:

Table II

Calculated Formulas of Good Glazes, Having 0.1KNaO, 0.9CaO as RO

Firing temp. (Seger cone)	RO	Alumina	Silica	Firing temp. (Seger cone)	RO	Alumina	Silica
11	1	0.70	6.0	15	1	1.01	11.0
12	1	0.80	7.0	16	1	1.06	12.7
13	1	0.88	8.2	17	1	1.10	14.5
14	1	0.95	9.5	..	.	..	..

TABLE III

CALCULATED FORMULAS OF GOOD GLAZES, HAVING 0.3KNaO, 0.7CaO as RO

Firing temp.	RO	Alumina	Silica	Firing temp.	RO	Alumina	Silica
11	1	0.80	7.0	15	1	1.05	11.2
12	1	0.87	7.7	16	1	1.08	12.8
13	1	0.94	8.6	17	1	1.10	14.7
14	1	1.00	9.8	..	.	..	..

(5) Along the major axis of lustre-area which has been named "Lustre Axis," silica varies proportionally with alumina. The ratio is 0.1 Al_2O_3: 1.0 SiO_2 except when glazes, with 0.1KNaO, 0.9CaO as RO, are burned at cone 11; in this case, the ratio is 0.1 Al_2O_3: 0.8 SiO_2. (6) The max. amts. of alumina and silica in the lustre-area are as follows:

Firing temp. (Seger cone)	RO = 0.5 KNaO, 0.5 CaO	RO = 0.1KNaO, 0.9 CaO
11	$1.3Al_2O_3$, $12SiO_2$	$1.1Al_2O_3$, $9SiO_2$
14	$1.5Al_2O_3$, $15SiO_2$	$1.5Al_2O_3$, $15SiO_2$
17	$1.9Al_2O_3$, $23SiO_2$	$1.9Al_2O_3$, $23SiO_2$

(7) Some of the glazes in lustre-area have crazed. Member at the center and those around it are safe while those near the boundary and, moreover, poor in alumina have tendency to craze. S. KONDO

87. How to prevent smoke from pottery kilns. S. MOMOKI. *J. Jap. Cer. Assoc.*, **349**, 474–80(1921).—A social question is now arising on the subject in some districts of the country. The author has long been investigating various methods of preventing smoke from kilns firing faience and porcelain. They are discussed in detail: (1) Elec. pptn. is too expensive; (2) use of pulverized coal is probably injurious, as the best domestic coals contain 10–20% of ash; (3) firing with heavy oil is too expensive; (4) expt. with Kraft's mechanical stoker has shown good result for faience, fired at cone 7; but the need of even-grained coal and the excessive burning-out of metallic parts make its use for hard-fire porcelain doubtful; (5) methods of consuming flue gases by the introduction of hot secondary air, such as P. A. F. Schultz's patent, are promising; but their application to old kilns is expensive or inconvenient; (6) gas firing with pressure-gas producer is probably better than the methods described above; (7) use of tunnel kilns is most promising; but gas firing and the use of tunnel kiln need ample space of which some factories are devoid. S. KONDO

88. Canadian feldspar quarries. EDITORIAL. *Can. Min. Jour.*, **43**, 515(1922).—This article makes special mention of the host of small feldspar quarries throughout Ontario and Quebec. O. P. R. O.

89. A china clay mine. ANON. *Can. Min. Jour.*, **43**, 523(1922).—Description of mine and mill of the Canadian China Clay Co. at Huberdeau, Quebec. The history of the company and the development work done is given; the geology, origin, character and size of deposits given; plant described; analyses of clay given and flow sheet of mill. O. P. R. O.

90. New uses for china clay. ANON. *London Times Trade Supp.*, **10**, 214(1922).—Colloidal clay is produced by chem. processes from china clay. It is a highly refined and purified material which commands lbs. per T. more than ordinary china clay. The production of this clay is arousing interest in china clay circles. O. P. R. O.

91. Electrical porcelain research. M. H. HUNT. *Elec. J.*, **19**, 94–6(1922).—The combined efforts of the elec. engineer, physicist, chemist and ceramist have resulted in the production of elec. porcelain along more scientific lines. A modern lab. is illus. Properties of the ingredients that enter the body, those of the body as a whole, and those of the fired porcelain are considered in evaluating elec. porcelain, in addition to the be-

havior on burning. For the present at least research will be largely cond. on present materials and present general procedures. Standardization of test pieces, app. and tests seems impossible. W. H. BOYNTON (*C. A.*)

92. Mechanical tests for raw materials used in the manufacture of porcelain. W. DEMUTH. *Elektrotechn. Z.*, **43**, 605–10(1922); 15 illus.—A detailed description of the new Hermsdorf lab. and equipment. C. G. F. (*C. A.*)

93. Electrical tests for porosity of electrical porcelain. J. E. SHRADER. *Elec. J.*, **19**, 118–9(1922).—The most important property of elec. porcelain is its dielec. strength, which is in turn indicated by power-factor and resistance. A simple test to det. how moisture absorption affects the latter properties is described. Four insulators of known history were dried overnight at 200° and after cooling filled with Hg and floated in a shallow tray of Hg. The power-factor was measured by a sensitive electrostatic watt-meter and the resistance with a sensitive high-resistance galvanometer. The Hg was then replaced by water and the measurements were immediately repeated. The insulators were allowed to stand in water for 7 days, measurements being made at intervals. Curves for the power-factor of each insulator are shown. Resistance measurements showed that the poorest one had a different moisture absorption. Dielec. tests on these insulators showed that this one punctured at low voltage. Further soaking tests in water and in dye showed that the recorded results are characteristic. The power-factor detn. is very good and a sure indication of moisture absorption which is an indication of the porosity of the porcelain. Resistance measurements only distinguish a good insulator from a poor one. The const. slope of the poor insulator may indicate failure under high potential when sufficient moisture has been absorbed and may be the cause of the deterioration of apparently good insulators on storage or long service. The work shows the direct relation between the power-factor of insulators and their dielec. strength and that barring mechanical troubles or faulty design it depends upon moisture absorption as a result of porosity. W. H. BOYNTON (*C. A.*)

94. Standardization of filter presses. ANON. *Chem. Trade J.*, **70**, 718–9; *Chem. Age* (London) **6**, 788–9(1922).—Report of a joint committee of the Assoc. Brit. Chem. Mfrs. and the Brit. Chem. Plant Mfrs. Assoc. E. H. (*C. A.*)

95. Process of manufacturing granite-porcelain. TOMOTARO KAWAMOTO AND GOSUKE KATO. Japan 40,582, November 9, 1921. A porcelain is made of a body which is prepd. by mixing coarse grains of granite to the other ingredients, *i. e.*, feldspar, quartz, amalgatolite, Kibushi clay, limestone and water. The fired products look like granite. S. KONDO

96. Process of manufacturing talc pottery. KOSUKE HIRANO. Japan 40,963, November 30, 1921. Magnesite, calcined at 600–1200°C, is added to the body materials of talc pottery. In most cases, the talc is previously heated at a high temp. S. KONDO

97. Artificial marble. ARAJIRO HISADA. Japan 38,873, June 11, 1921. Plastic porcelain bodies of different colors are cut to irregular pieces and thrown together in a mold, then the mold is filled with similar body of white or other color and pressed. The shaped body is fired after drying. The surface of the fired product is, sometimes, polished. S. KONDO

98. Process of decorating pottery. KOSABURO KANO. Japan 38,872, June 11, 1921. A design or lettering is printed on paper with a paste composed of glaze 8, orchid-root 1, syrup, sugar or rice-jelly 1 and proper amt. of warm water, then it is transferred on biscuited ware; a hard-fire color is painted on the design or lettering and its neighborhood. The print repels the color and remains uncolored. Now glaze is applied on the whole surface and the ware is fired at high temps. S. KONDO

PATENTS

99. Apparatus for the manufacture of pottery ware. Richard H. Wainford and Charles H. Darling. U. S. 1,408,663, March 7, 1922. In apparatus of the class described, the combination of a machine for forming clay and a drying stone having a series of movable ware-boards, means intermediate the machine and the drying stove whereby the movement of the ware-boards is synchronized with the operation of the machine, and means for automatically stopping the operation of the machine at a predetermined stage of its operation. C. M. S., Jr.

100. Process of forming clay image. Eizaburo Murakoshi. Japan 39,732, August 30, 1921. Clay images, imitating ancient "Haniwa," are formed with plastic clays, using a cloth bag filled with sand as core, which is taken out afterwards by discharging the sand. The images are then fired in a kiln. S. Kondo

101. Process of fixing a tack to an artificial tooth. Isuke Ogawa. Japan 39,267, July 14, 1921. A vertical slit and a horizontal hole are made so as to meet at a point within a porcelain tooth. After firing at a high temp., a small plate of silver or brass is inserted into the bottom of the slit and a tack of platinoid, gold or nickel into the hole. Then the tooth is heated to the m. p. of the plate to weld it with the end of the tack. S. Kondo

102. Firing earthenware. C. J. Kirk. U. S. 1,418,446, June 6. The articles to be fired are passed through heating zones in which the temps. are independently controlled. (*C. A.*)

Art and Design

103. The constitution of some ceramic coloring materials. R. Rieke and W. Paetsch. *Ber. der Deut. Ceram. Gesellschaft*, **3**, Pt. 3, 147–56(1922).—On heating mixts. of oxides together contg. either Cr_2O_3, Al_2O_3, or Fe_2O_3 as one component, compds. are obtained with the general formula $RO.R_2O_3$. Of these compds., many of which show characteristic colors, the chromites are chem. most stable, and are well suited for underglaze colors. The formation temp. differs for the various compds., being quite low for those contg. ZnO. In contrast to the chromites, the aluminates and ferrites are easily decomposed or dissolved by glazes, depending somewhat on the compn. of the glaze. The chromites are also decomposed by glazes high in PbO and low in clay, part of the Cr_2O_3 going over to chromite. E. N. Bunting

See Abs. 84.

Heavy Clay Products

104. The laying of wall tile. G. Steinbrecht. *Keram. Rundschau*, **30**, 287 (1922).—Tiles are molded with oblique grooves on the rear which makes them adhere to the wall better. The ends also are molded at 45°. H. G. Schurecht

105. Concrete tile failures in alkali soil. E. V. Willard. *Brick & Clay Record*, **61**, 248(1922).—Concrete tile are destroyed by the water in 14 counties of the 22 southwest counties of Minn. The total salt content of soil moisture exceeds 0.01% in each of these cases. H. G. Schurecht

106. On plasticity of clays. J. W. Mellor. *Trans. Ceram. Soc.* (Eng.), **21**, 91–103(1922).—Plasticity enables a clay to change its shape without cracking when subjected to a deforming stress. The elasticity of the wet clay is negligibly small. Clay possesses high binding power when dried and fired, so that the form impressed on the clay is retained more or less persistently. Many definitions of plasticity confuse these two distinct properties and assume that the binding power is implied in the term plasticity. A great many methods for measuring plasticity are based on the binding power of the dried clay. This is not always true. No known property of the dried

clay can be used as an infallible index of plasticity and measurements of plasticity dependent on some property of the dried clay can therefore be dismissed. Plasticity is a mechanical property. Until shown that it is a definite function of some quality such as dye-absorption, viscosity of slip, etc., it can not be assumed without reservations that measurements of these qualities measure plasticity. A modified colloidal hypothesis gives the best working explanation of several properties of clay. The stuff obtained by evapg. the "clear" liquid from ball clay, is a deep, hard, horny mass resembling glue. It adheres to the tongue tenaciously and, like glue, swells enormously when wet with water and shrinks and cracks when dried. Cornish china clay gave about 0.005% and Devonshire ball clays gave about 0.05%. It is doubtful if this product represents all the colloidal matter in these clays. No difference could be detected in the plasticity of the clay from which *l'argile colloide* had been removed. M. is inclined to think that the colloid plays an important part in the drying of clay. H. F. S.

107. The dehydration of dried clays. J. W. Mellor, N. Sinclair and P. S. Devereux. *Trans. Cer. Soc.* (Eng.), **21**, 104–6.—Finely powdered samples of clay were dried over 25 per cent sulphuric acid, and placed in desiccators containing sulphuric acid of different concentrations at a constant temperature of 25°. The samples were weighed every week until constant. The time occupied was approximately three months. If years were available, possibly more water would be lost by the clay.

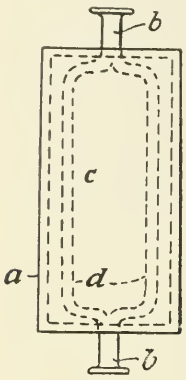
Percentage Loss in Weight on Exposure of Different Clays in Dried Atmospheres

Per cent H_2SO_4	Ball clay	China clay	Glenboig clay	Halloysite	Kaolinite	China clay	Halloysite
30	0.08	0.16	0.09	0.10	0.06	0.01	0.06
40	0.24	0.12	0.11	0.41	0.08	0.06	0.44
50	1.63	0.20	0.30	0.93	0.12	0.13	1.67
60	2.31	0.24	0.48	1.84	0.18	0.16	1.96
70	2.44	0.46	0.67	1.92	0.24	0.23	3.26
80	3.29	0.52	1.12	2.37	0.38	0.36	3.62
90	3.54	0.55	1.48	2.58	0.46	0.50	4.05

E. Lowenstein's observations are thus confirmed. Water, combined in clay, is reversible, restored in a moist atmosphere, showing that no drastic change has occurred in the structure of the clay molecule. This change is different from that when water is expelled at higher temps. Resorption of water is so slow that it requires a long time to restore the original plasticity; hence the working qualities, plasticity, shrinkage, etc., of certain troublesome clays can be modified and regulated by dessication. The dried clay like unweathered fire clays requires exposure to moist atmosphere for a long time before the original plastic condition is resumed. The custom of seasoning glass pots for a few months in a warm, dry place may not be so redundant an opern. as might be supposed. Storing of clays in a warm, dry spot is injurious to plasticity. H. F. S.

108. Apparatus for drying bricks, stones, and ores. R. E. Cowell, of Urmston, Eaglescliffe, S. O., Co. Durham; and A. Wilkinson, of Clyde House, Eaglescliffe, S. O., Co. Durham. *Quarry, Surv. Contractors' Jour.* (London), **266**, 27 (1922).—Relates particularly to apparatus for this purpose, in which the material to be dried is spread on trays, heated by passing a heating agent such as steam or hot air into internal passages provided, into the body of the trays. According to the invention, a portable drying floor for drying bricks, stones, and ores, consists in a hollow tray made up of one single piece, casting, sheet, plate, or the like, of iron, concrete, ferro-concrete, or any

other suitable material, adapted to be heated by passing live or exhaust steam, waste hot gases, or any other suitable hot fluid, through the internal passage of the tray, so as to heat it by direct contact with hot fluids or through pipes, perforated or unperforated, led through the space inside the body of the tray, each tray constituting a distinct and separate drying unit. Several such trays may be connected by suitable coupling members to constitute a larger drying floor. A suitable non-conducting material or lagging may be applied externally to the tray or some portions thereof if required. The accompanying drawing shows a hollow tray provided with internal pipes forming two branched circuits. O. P. R. O.



PATENTS

109. Process of manufacturing light brick. KINJI KATADA. Japan 41,372, January 11, 1922. Bricks are formed with a body which is prepd. by mixing and kneading coarse grains of coal-cinder, contg. 25–35% of combustible carbonaceous substances, saw-dust and fire clay. They are afterwards fired in a kiln. S. KONDO

110. Method of making drain tile. P. FUNK. U. S. 1,408,877, March 7, 1922. The method of making drain tile, which consists in puncturing the tile body with a plurality of parallel rows of diagonal perforations, which are laterally parallel to each other, by means of a series of puncturing needles mounted on a common shaft, which is driven reciprocally in a diagonal direction outwardly, in such a manner as to thrust the needles periodically in a slanting direction through the body of the tile while in a plastic condition, and passing from the tile press. C. M. S., JR.

111. Off-bearing mechanism for tile cutters. ALFRED G. HAGUE. U. S. 1,411,492, April 4, 1922. In a device of this kind, spaced pneumatic grippers having means for supporting and moving them from a receiving position to a delivery position, and vice versa, and means for actuating the grippers when in a receiving position to grasp a plastic block, or brick, and to deliver the same when in a delivery position. C. M. S., JR.

112. Brick pallet. LEONARD G. WOODS. U. S. 1,416,432, May 16, 1922. A pallet for supporting bricks before and during the burning thereof, consisting of a sheet metal plate adapted to receive and support the green bricks, the plate being thinly covered with a closely adherent enamel, whereby to prevent sticking of the brick to the plate and reaction of the metal with the constituents of the brick. C. M. S., JR.

113. Hollow building tile. JOHN W. AGER. U. S. 1,414,246, April 25, 1922. A hollow building tile substantially rectangular, having in a rear corner portion thereof transverse and lengthwise intersecting partitions defining with the adjacent ends of the rear and side walls of the tile a substantially rectangular cell, there being weakened fracture lines in the two outer walls of the cell remote from the corner of the tile and so disposed and arranged that by breaking off the rear corner of the tile a jamb block is formed. C. M. S., JR.

114. Machine for manufacturing bricks. SÔTARÔ TAKAHASHI. Jap. 39,444, Aug. 3, 1921. (*C. A.*)

Glass

115. On the nature of the coloring properties of selenium red. A. A. GRANGER. *Trans. Ceram. Soc.* (Eng.), **21**, 89–90(1922).—Cadmium red is a red pigment. Introduced in a suitable flux gives a brilliant and beautiful enamel. Glassmakers produce the same color known as selenium red. Chem. constitution of both cadmium and

selenium red is unknown. Recipes for prepg. selenium red consist essentially of heating materials containing sulphur, selenium and cadmium. Sulphur may be introduced as sulphur, sodium sulphide, sodium hyposulphite or sodium sulphite. The selenium as selenium, sodium selenide or selenite or selenate and the cadmium as oxide, carbonate or sulphide. Success of prepn. does not depend on ratio between ingredients; but chiefly on method of heating and temp. Insufficient heating does not give red coloration; excessive heating produces brown or black. The best method is to heat gently on a wide surface; mixt. slowly stirred and examnd. from time to time when cooling. When hot, the pigment is more brown than when cold. At about 700°C the coloration is subject to alterations. A rapid heating will cause the sulphur to ignite, and after combustion has ceased a beautiful vermilion surface coloration is observed. If the mixt. is brown, some sulphur must be added, the whole being stirred. H. F. S.

116. American made 40-inch telescope disc. Donald E. Sharp. *Glass Worker*, **41**, No. 45, 9(1922).—The method of making telescope discs is given in some detail. A melt of borosilicate glass was cast in an iron mold lined with fire brick and talc. The disc was annealed in a gas-heated fur., being held 14 days at 464°C. The cooling rate started with 0.2°C per hr. and increased to 6°C per hr. R. J. Montgomery

117. Proper control of pot furnace conditions. Henry W. Hess. *Glass Worker*, **41**, No. 32, 11(1922).—Discussion of the causes of variation in furnace results due to temperature draft, etc. R. J. Montgomery

118. Glass for laboratory and scientific purposes. Anon. *Schnurpfeil's Review for Glass Works*, **6**, No. 64, 1247(1922).—Alumina is generally used as Al_2O_3 or as the hydrate. Three batches are given: (1) Sand 100, hydrate of alumina 5, soda ash 35, lime 20. (2) Sand 100, hydrate of alumina 6, zinc oxide 1, borax 2, soda ash 35, lime 18. One of fluorspar or sulphate may be added. (3) Sand 100, soda ash 34, hydrate of alumina 6.5, borax 6, lime 18. Alumina may be increased to 8 and borax to 10 and 1 or 2 of magnesia added. Often 1 lb. of saltpetre and .5 lb. arsenic is added to batch to improve melting. R. J. Montgomery

119. Study on the life of pots, used in round pot-furnaces. K. Ishikawa. *J. Jap. Cer. Assoc.*, **350**, 519–34(1921).—The study includes elaborate investigations of 810 closed pots with capacity of 600 lbs. of glass and 308 "Japan pots" with capacity of 500 lbs.; it took 4 yrs. Furnaces with direct firing and those with half-gas firing were used; in either case, the flame, after ascending to the combustion chamber and playing around 3 to 6 pots, so arranged as to form a ring, was made to pass through the openings under the mouths of pots. The life averaged 12.0 meltings for covered pots and 9.5 for "Japan pots." 75% of damages in the closed pot were caused by cracking and remaining 25% owed to corrosion. 45.2% of cracks in the closed pots took place on the right and left sides. Different periods in which cracks appeared, the manner of growth of cracks, and the relation between parts of pots and the size of cracks are described. Damages due to corrosion took place chiefly at or near bottom and at the level of metal. Various expts. were done to find the cause of faults in glass of a factory where wares with stone or cord amtd. to 19.09% at that time. Of 19.09%, 3.8% were ascribable to the unskilfulness of workers, 8.4% to the age of pots, 2.2% to corroded rings, 1.76% to corroded stoppers and 0.7% to too coarse sand; thus, only 2.23% were due to unknown causes. Pots with moderate weight had the longest life. Generally speaking, the slower they are dried, the better they wear. The life is also increased by storing the plastic body longer. It depends on season of making and also on the size of grains of raw materials. The position of pots in furnace has remarkable effect. The temp. and duration of heating pots in pot arch are discussed. S. Kondo

120. On the utilization of selenium. S. Sugie. *J. Jap. Cer. Assoc.* **341**, 152–5; **342**, 193–5; **343**, 226–30(1921).—The chamber-mud of Jap. factories mfg. sulphuric

acid contains 2–6% of selenium. Flue-dust, anode-slime, slag and other by-products of factories treating sulphur or sulphide ores are also rich in the element, as Jap. ores contain more selenium than those of other countries. I. *The recovery of selenium from waste products.* Of many well-known processes of extracting selenium from chamber-mud, anode-slime, flue-dust etc., the following two are recommended: (*a*) Selenium is pptd. by means of concd. hydrochloric acid from soln. of sodium thioselenate which has been obtained by heating the material with soln. of sodium sulphite; and (*b*) selenium in the material is oxidized by heating with concd. nitric acid; then sulphuric acid is added to drive off the excess of nitric acid; selenium is pptd. from the soln. with sulphurous acid gas, sodium sulphite and hydrochloric acid, or hydrogen sulphide. II. *Red pigment of selenium for enamel.* Four kinds of fire-red, imported from Germany before the war, had shown following compns.:

	No. 1	No. 2	No. 3	No. 4
Cadmium	28.2%	24.3%	17.3%	39.1%
Alumina	36.4	53.8	49.4	45.5
Sulphur and selenium	35.4	11.9	33.3	15.4

Starting from the result, many expts. were done, and a new method of mfg. pigments which are as satisfactory as German fire-red has been invented. The method is as follows: mixt. of cadmium sulphide and selenium is heated in a porcelain crucible gradually up to about 500–700 °C and the temp. is kept till the content becomes dark brown and the fuming of violet selenium is almost over, stirring the content at times; it is then cooled, still stirring the content; batch-compns. were:

	D	E	G	F	H	A	B	C
Cadmium sulphide	82%	85%	85.5%	86%	86.5%	87%	89%	90%
Selenium	18	15	14.5	14	13.5	13	11	10

The color of the pigments changes continuously from blackish red of D to yellowish red of C. Black shade is also added by heating to higher temps. or heating up rapidly and continuing it longer. For enameling, a coating of transparent frit with 3–5% of the pigment is applied and fired on white coating. Of several frits used for the purpose, one composed of 33 sand, 30 borax, 15 fluorspar, 6 cryolite, 14 sodium carbonate and 2 nitre gave the best results. III. *Use of selenium as pink colorant and decolorizer of glass.* A historical survey on the subject is given. Concluding from many expts. the author says: (1) selenium does not color soda-lime glasses pink, but tends to give them a yellowish brown; (2) selenium, regardless of its sources, colors potash-lime glasses pink; (3) the amt. of selenium required for decoloration is about 1.5% of the amts. of ferric oxide in batches; (4) $CaSeO_3$, $BaSeO_3$ and $PbSeO_3$ are the most effective sources of selenium; (5) the action of selenium is hindered by the presence of oxidizing substances, *e. g.*, red lead; (6) the required amt. of arsenious oxide is about 3 times that of selenium. In either case, it is impossible to get a dark red glass by selenium, as it is volatile at high temps. In general, selenites of alkalies or ammonium are very hygroscopic, therefore they are inconvenient in use. S. KONDO

121. Opal glass and alabaster glass, and their applications. K. FUHA AND Y. YOSHIOKA. *J. Jap. Cer. Assoc.*, **345**, 302–17(1921).—A detailed historical survey and its discussions on the manuf. and theory of opal glass and alabaster glass are given. I. *Experiments.*—The wt. of each batch was 3 kg. for preliminary work, then it was increased to 10 kg., and at last 100–200 kg. batch was taken to manuf. various vessels or lighting goods for trial. Pot was heated by gas or heavy oil, and the temp. in fur. was completely under control. (1) Opal glass. (*a*) Silica or alumina as opacifier. Soda-lime glass, contg. more than 75% of silica, is sometimes devitrified in cooling or annealing. Aluminous hard glass, also, devitrifies in heating repeatedly. (*b*) Fluorine

compds. as opacifier. In this case, glasses composed of 65–68% silica, 9–10% lead oxide, 8–10% alumina, 2–3% lime and 12–14% alkalies were used. The rôle of alumina is to reduce the corrosive action of fluorine compds. on the pot. Introducing varying amts. of fluorine to the glass, it has been found that when feldspar or amalgatolite is used as the source of alumina about 2.5 parts of fluorine per 100 parts of glass is required for the production of opal glass, irrespectively of the kind of fluorine compds. which include fluorspar, sodium fluoride, cryolite, fluorspar and sodium fluoride whereas about 4% of fluorine is required when prepd. alumina is used. (*c*) Bone-ash as opacifier. A deep opal glass was obtained by melting a batch composed of 1200 sand, 800 litharge, 400 potash, 120 nitre, 75 borax, 20 arsenious oxide and 200 bone-ash, but it was translucent in molten state. If we cool the glass to about 800°C and heat it gradually to 1000–1100° and keep at these temperatures, a translucent glass like alabaster will be obtained. Replacing potash with same amt. of soda-ash, no effect was observed. When the amt. of bone-ash was reduced to 150 parts, a translucent glass was obtained; a batch with 100 parts of it gave a transparent one. (2) Alabaster glass. (*a*) With fluorine compds. and auxiliary agents. Since it has been ascertained in the expts. of (1) (*b*), that translucent glasses are obtained by introducing about 2% of fluorine to the said glasses when feldspar or amalgatolite is used, or by introducing about 3.5% of fluorine when alumina is used, these batches have been used as bases. Expts. with these batches to which 0.5–3.0% of various auxiliary agents were added have shown that the introduction of 1.5% or more of strontium or barium sulphate or 3.0% of calcium sulphate gives an alabaster glass. The efforts to use chlorides were useless, but mixts. of sulphate and chloride gave good results. The research resulted in the introduction of "Johga Glass" on market. (*b*) With asbestos. Asbestos batch, such as 1000 sand, 380 potash, 125 litharge, 100 asbestos and 40 nitre, gives a good alabaster glass when it is heated at a constant temp. for a certain time after it begins to melt. Melting at too high temps. makes it transparent. II. *Causes of translucency and opacity.*—(1) Opal glass is produced (*a*) by setting free colloidal silica or alumina from glasses contg. an excess of silica or alumina, (*b*) by similar cause from glasses containing flourine compds., (*c*) or by dispersing calcium phosphate colloidally in a glass. (2) Alabaster glass is produced (*a*) by the suspension of minute particles or colloid of silica or alumina, together with gaseous substances, (*b*) by the suspension of minute substances or crystals of substances other than silica or alumina, *e. g.*, magnesium silicate, together with gaseous substances, (*c*) or by dispersing substances coarsely. Microphotographs are given. Microsections of Johga glasses show innumerable gas-bubbles, ranging from 10 microns to visible size. Physical properties are described, for instance:

TABLE I

	Reflection	Transmission	Absorption	Sp. Gr.
An ordinary opal glass	70.0%	21.0%	9.0%	..
Johga glass No. 1	36.7	45.0	18.3	2.06
Johga glass No. 2	42.5	49.4	8.1	2.66
Johga glass No. 3	45.5	47.8	6.7	2.52

S. KONDO

122. A note on optical glass. R. SHIBATA. *J. Jap. Cer. Assoc.*, **349**, 481–5(1921).—Descriptions on several specimens of optical glasses which have been manufd. at the naval arsenal, Tokio, their materials, and chief raw materials of pots are given. Process of making pots is explained. S. KONDO

123. Color of glass imparted by iron. K. FUHA. *J. Jap. Cer. Assoc.*, **354**, 39–57 (1922).—Over 1500 different batches were melted to ascertain the effect of variation in the compn. of glass and the influence of oxidizing or reducing agents on the color

of glass imparted by iron. Pure chem. and ground rock-crystals were used. Three formulas were used as bases: (1) R'_2O, $R''O$, $3SiO_2$, (2) R'_2O, $R''O$, $0.5B_2O_3$, $3SiO_2$, and (3) $1.3R'_2O$, $0.7R''O$, $6\ SiO_2$, where R'_2O represents K_2O or Na_2O and $R''O$ represents CaO, MgO, ZnO, BaO or PbO. Glasses belonging to (1) or (2) were melted at 1300–1350°C while those of (3) were melted at 1400–1550°C. The color imparted by ferric oxide is described. Generally speaking, it colors soda glass blue or bluish green and potash glass yellowish green or green. The increase in the colorant adds yellow shade to soda glasses and blue shade to potash glasses. However, there are exceptions where no difference is observable between soda and potash glasses. The difference in $R''O$ affects the color, *e. g.*, ferric oxide imparts dark reddish brown to Na_2O, BaO, $3SiO_2$, light blue to Na_2O, CaO, $3SiO_2$, dull blue to Na_2O, ZnO, $3SiO_2$, and yellowish tint to Na_2O, PbO, $3SiO_2$. Boric acid does not affect the color, although sometimes it darkens or brightens the color. Besides, detailed descriptions are given on (1) the color imparted by ferrous oxide, ferric chloride, ferrous sulphate, ferrous carbonate or ferrous oxalate, (2) the effect of sodium carbonate or potassium carbonate on the coloration of ferric or ferrous oxide and (3) the effect of potassium-sodium tartrate or arsenious acid on the color, imparted by ferric or ferrous oxide. S. KONDO

124. Study of chemical glass ware. T. OGAWA. *J. Jap. Cer. Assoc.*, **355**, 91–7; **358**, 252–65(1922).—The results of chem. analyses and tests on the resistance to chem., impact and the sudden change in temp. of foreign and domestic chem. glass wares as well as those made by the author are given. In general, home products are inferior to foreign ones, owing to their improper compns. Furnaces producing high temps. and pots standing them are indispensable for mfg. chem. glasses of the best quality, since the constituents of glass which increase its resistance to chem. make it more refractory. Batches contg. proper propns. of zinc oxide, alumina, magnesia, boric acid and silica suit fur. with half-gas firing. The use of sands contg. alumina, feldspar, or dolomite is economical. S. KONDO

125. On the surface devitrification of sheet glass. Y. AMENOMIYA, K. KOJIMA AND H. OTA. *J. Jap. Cer. Assoc.*, **356**, 137–51(1922).—The paper relates to the surface devitrification of finished sheet glasses by ht. treatments. An elec. fur. was used. The microphotographs of several sheet glasses of two factories which have been heated to various temps. indicate that the temp. at which crystals begin to appear is about 700°C. The crystals produced at this temp. are spherulitic while they are changed to radiating needles, by heating at 750°. At 900°, the crystn. proceeds into interior of glass and it becomes a white sheet. At certain higher temps., the crystals melt and disappear; these temps. were 985–1130°C for 8 kinds of sheet glass. The reln. between devitrification and time of heating at various temps. is described. The time required for the devitrification which occurs in cooling a molten glass is far longer than that required for the devitrification in heating up. S. KONDO

126. Atmospheric pressure and refractive indices, with a corresponding table of indices of optical glass. J. W. GIFFORD. *Proc. Roy. Soc.* (London), **100A**, 621–6 (1922).—In work where an accuracy better than about a unit in the sixth significant figure is required it is necessary to allow for the effect of the variation of refractive index of air with variation in the barometric pressure. A table is given of the refractive indices to 7 figures for 13 different wave lengths from 7682 K to 4046 Hg for 3 crown and 4 flint glasses. E. D. WILLIAMSON (*C. A.*)

PATENTS

127. Method and means for forming and transferring gobs of molten glass. JOHN F. RULE. U. S. 1,413,788, April 25, 1922. The combination with a receptacle for molten glass having an outlet opening, of a mold below the opening open at its upper end and formed with an elongated tapered mold cavity smaller at the lower end than the

upper end, gob-transferring app. between the flow opening and mold comprising a carrier, transfer cups at the opposite sides of the carrier, the cups having gob-forming cavities shaped to conform substantially to the form of the mold cavity, means to intermittently rotate the carrier and swing the transfer cups alternately from receiving position to discharging position, and means to sever the glass and support the oncoming stream during the rotation of the cup carrier. C. M. S., Jr.

128. Glass-flow-off controller. Frank O'Neill. U. S. 1,413,183, April 18, 1922. The combination with a container for a pool of molten glass, the container having an outlet for the glass below the surface of the pool, of controlling means for the outlet comprising a support, a refractory plunger projecting downward into the pool and having an intermediate ht.-weakened portion, the plunger embodying an upper portion sustained by the support independently of the portions therebelow, the upper portion having a central passage therethrough to a lower portion, a threaded seat, a reinforcing stem for the refractory having threaded engagement with the seat, a ht. expansion take-up spring about the stem, the spring being sustained by the support for yieldably maintaining the plunger refractory portions assembled therewith, the upper held refractory portion relieving the ht. weakened intermediate portion from crushing strain, and the stem carried lower portion relieving the heat weakened intermediate portion from tension strain, thereby distributing the load of the plunger, and means for shifting the support to vary the submergence of the plunger in the pool and normally maintaining the support in plunger sustaining position. C. M. S., Jr.

129. Apparatus for the manufacture of glass in continuous sheets. Eugene Rowart. Belgium 1,413,238, April 18, 1922. In an app. for the manuf. of glass in continuous sheets, in combination, a melting fur. for the production of molten glass, a chamber communicating with the melting fur., burners at the ends of the chamber, whereby a high temp. is produced all around the chamber, a working chamber arranged between the burners and within the chamber, and a taking app. dipped in the molten glass contained in the chambers, the taking app. being located with its upper part in the working chamber and communicating directly at its lower end with the chamber containing the molten glass, the working and the upper part of the taking app. being vertically movable and separable from the lower part of the taking app., whereby the hot gas from the burners may act on the whole surface of the molten glass contained in the chamber and also within the taking app. C. M. S., Jr.

130. Method and apparatus for making glass. Hubert A. Myers. U. S. 1,413-766, April 25, 1922. Apparatus for making glass, comprising means to provide a reservoir supply of molten glass, means to form an opening or space for shaping the glass, through which the discharge of glass flows in molten condition from the reservoir, and instrumentalities to maintain the sides of the opening or space at a sufficiently high temp. to retain the necessary fluidity of the glass, and so that the sides of the opening will remain glazed with the highly liquid molten glass which adheres thereto from the passing flow, together with means to keep the glazed sides moving with the flow of glass. C. M. S., Jr.

131. Stirring molten glass in continuous tank furnaces. Wilber F. Brown. U. S. 1,414,008, April 25, 1922. The combination with a continuous tank fur., whereby the molten glass flows continuously from the melting end to the delivery end of the tank, of an internally cooled rod extending transversely into the tank above the flowing glass, a porcelain stirring finger projecting downwardly from the rod into the flowing glass, and means for automatically and continuously reciprocating the rod, whereby the finger will break up the continuous flow lines in the glass and increase its homogeneity. (Cf. *Ceram. Abs.*, **1**, 79(1922).) C. M. S., Jr.

132. Means for filling glass melting tanks. Seth B. Henshaw. U. S. 1,409,716,

March 14, 1922. In an app. for filling glass melting tanks, a hopper adapted to be mounted adjacent the filling opening of the tank, means for moving the hopper to discharging position within the opening, a closure for the opening, and interconnecting means between the closure and hopper, so that one of them is moved into the opening when the other is moved away. C. M. S., Jr.

133. **Ring mold for glass presses and the like.** Peter Kucera. U. S. 1,412,358, April 11, 1922. As an article of manuf. a ring mold for pressed glassware and the like, the ring mold comprising a body portion of relatively soft metal and having the base of the matrix groove and an inner edge of hardened compacted metal integral with the soft body portion. C. M. S., Jr.

134. **Processes and apparatus for feeding glass.** William J. Miller. U. S. 1,413,757, April 25, 1922. In a glass feeder, for use in connection with a container for molten glass provided with a discharge port, the combination of reciprocating mechanical means for discharging glass at intervals through the discharge port, and for attenuating the neck of the protruding glass to facilitate severance, means for severing the neck to form gathers, and a pushback to be inserted into the outer end of the port for forcing the severed neck back into the port to temporarily interrupt the flow of glass. C. M. S., Jr.

135. **Conveyor for heated glassware.** Alexander Samuelson. U. S. 1,414,212, April 25, 1922. A conveyor for supporting and transporting heated glassware without cracking the same, which has a roughened surface to provide air cushioning and air insulation between the surface and the glassware to retain the heat in the latter. C. M. S., Jr.

136. **Method of treating and working glass.** Enoch T. Ferngren. U. S. 1,415,824, May 9, 1922. The method of forming mold charges which consists in flowing a stream of glass freely through a surrounding heat delivering flame and a heated shearing medium towards a series of molds successively elevating towards the stream and shearing medium, and successively severing mold charges at the shearing medium without obstructing the downward movement of the remaining portion of the stream. C. M. S., Jr.

137. **Apparatus for drawing glass.** Allen P. Wittemore. U. S. 1,415,133, May 9, 1922. An app. for drawing glass cylinders, a cooling ring arranged to surround the cylinder adjacent to the drawing point, and a sectional shield detachably secured adjacent to the inner face of the ring for locally retarding its cooling effect upon the article being drawn. C. M. S., Jr.

138. **Glass-cutting square.** Henry E. Johnson. U. S. 1,415,650, May 9, 1922. A glass support and cutting guide comprising a pair of right-angularly connected arms, oblique braces between the arms, the arms and braces being adapted to support a sheet glass to be cut, one of the arms having a vertical longitudinal stop rib for one edge of the glass, both of the arms having graduations, the inner end of the rib terminating adjacent the inner edge face of the other arm, a cutter guiding arm pivotally connected to the outer end of the other arm, and a detent by the inner end of the rib for gripping engagement with the free end of the pivoted arm, to releasably hold the arm against the end of the rib and the glass on the angularly connected arms and braces. C. M. S., Jr.

139. **Glass composition.** Harry T. Bellamy and Burton T. Sweely. U. S. 1,415,980, May 16, 1922. A binder for higher resistance compns., comprising a non-electrolytic glass composed of silicates and borates of calcium and barium. C. M. S., Jr.

140. **Glass-handling apparatus.** Earl G. Chase. U. S. 1,414,547, May 2, 1922. A glass horse comprising a supporting base, series of uprights mounted at opposite sides

of the base, saddles comprising flexible members suspended between corresponding upright of the two series, the saddles being normally slack, and means whereby the slack of the saddles may be independently adjusted. C. M. S., Jr.

141. Apparatus for feeding glass to molds. Enoch T. Ferngren. U. S. 1,414,561, May 2, 1922. In an app. for sepg. molten glass into mold charges, the combination of a container for the glass provided with a submerged discharge outlet, a hollow member having its lower end submerged in the glass opposite the outlet and spaced therefrom, and rigid means for creating a flow of the glass in the member toward and from the outlet. C. M. S., Jr.

142. Mechanism for transferring glassware. Richard La France. U. S. 1,413,741, April 25, 1922. The combination with an endless conveyor adapted to receive and convey articles seriatim, of a stop in the path of the articles to arrest them while on the conveyor, means to shift the articles laterally off the conveyor, a gripper, and means to operate the gripper to engage the articles, move the gripper bodily forward and then release it from the article. C. M. S., Jr.

143. Milky semitransparent glass. Kitsuzô Fuwa and the Tokyo Denki Kabushiki Kaisha (the Tokyo Electric Co.). Jap. 39,448, Aug. 3, 1921. Glass is made by adding 1.5–3.0% cryolite, 0.5–3.0% $BaSO_4$ and below 1% NaCl to a common glass. The best total compn. is sand 100.0, steatite 35.5, litharge, 7.5, ZnO 3.0, $NaNO_3$, 6.1, Na_2CO_3 34.6, boric acid 4.5, arsenic oxide 0.5, $BaSO_4$ 1.5, cryolite 3.8, NaCl 1.9 and antimony oxide 0.4. Microscopical bubbles produced in the material make it milky and semi-transparent. It is suitable for illuminating materials, such as shades for elec. lamps. (*C. A.*)

144. Opal glass. A. L. D. d'Adrian. U. S. 1,419,032, June 6. An ordinary glass compn. is combined with fluostannite of Mg, Ba or Pb or other metals or silicofluorides to produce opal glass. (*C. A.*)

Enamels

145. Effect of variation in the composition of ground-coat enamel on its adherence to iron. S. Mori. *J. Jap. Cer. Assoc.*, **343**, 233–6; **344**, 272–7(1921).—Adherence of ground-coat to iron was measured by impact test, using soft steel sheets, gauge No. 28 and 1″ x 2.5″ large, as test pieces. An enamel which had proved to be very good in practice was taken as the basis of expts. Its formula is 0.455 Na_2O, 0.245 K_2O, 0.232 CaO, 0.016 CoO, 0.955 MnO, 0.198 Al_2O_3, 1.490 SiO_2, 0.455 B_2O_3, 0.200 F_2. Now the content of silica, boric acid, alumina, soda, potash or lime was varied within ranges as follows: 1.266–1.754 SiO_2; 0.455–3.200 B_2O_3; 0.198–0.227 Al_2O_3; 0.426–0.561 Na_2O; 0.214–0.306 K_2O and 0.136–0.544 CaO. Conclusions are: (1) Any increase in silica or boric acid reduces the resistance to chipping; (2) the resistance of enamel to chipping increases with the addition of alumina; (3) adherence of ground-coat is strengthened by the increase of soda, potash or lime up to a certain degree beyond which the effect is reversed. S. Kondo

146. Study of vehicles used in enamelling slip. S. Mori. *J. Jap. Cer. Assoc.*, **352**, 630–40(1921).—Explanations and discussions on the reason why enamellers use vehicles or stiffening materials, the rôle of clay in enamelling slips, theories of deflocculation of the slip, and the action of vehicles on the slip are given. The effect of various vehicles on the viscosity of an enamelling slip is shown with diagrams. A ground coat enamel with formula as 0.455 Na_2O, 0.245 K_2O, 0.232 CaO, 0.016 CoO, 0.055 MnO, 0.198 Al_2O_3, 1.49 SiO_2, 0.49 B_2O_3, 0.20 F_2, ground with 5% of washed Gairome (plastic kaolin) and 35% of water, was used for the expts. The amts. of vehicles required for one litre of slip in making its viscosity most suitable for working were as follows:

sodium chloride 4.68 g., barium chloride 0.732 g., aluminium chloride 0.3 g., sodium carbonate 8.4 g., ammonium carbonate 0.9 g., borax 1.08 g. or brine 4 cc. The effect of vehicles diminishes with the lapse of time. Concluding from the results, the author recommends (1) the use of least water, (2) the removement of water on storing slips, (3) when the use of vehicle is needed, borax, ammonium carbonate or soda-ash for ground coat, barium chloride or soda-ash for cover coat, and aluminium chloride or calcined magnesia for sol. enamels as semi-fused ground coat of cast-iron ware, and (4) the use of stiffened slip within a few hours. S. KONDO

147. Study of the opacity agents for enamels. T. UCHIDA. *J. Jap. Cer. Assoc.*, **357**, 189–201(1922).—Although antimony which is generally used in Japan for making white enamels is inexpensive and effective, so far as opacity is concerned, it is by far inferior to stannic oxide as to the appearance of enamel and moreover enamels with antimony can not be exported to some countries where their use is forbidden, and consequently the study of its substitutes is needed. The results of numerous expts. in which various substances were ground with 10 times its weight of frit, made from 26 kg. borax, 59 kg. feldspar, 2 kg. nitre and 13 kg. cryolite, applied on sheet iron and fired after drying are as follows: (1) Among opacifiers on market and those substances which were considered of high promise, only two specimens of stannic oxide proved to be excellent, Terrar, zirconia, cerium carbonate, and a specimen of stannic oxide were good and antimony oxide, rutile and Izushi clay were pretty good; (2) of various metal oxides, obtained by calcining oxalates, those of tin, zirconium, antimony and cerium were good and the oxides of lead, zinc and arsenic were pretty good; (3) among several compounds of tin, stannic oxide obtained by calcining the hydroxide at 1050°C was excellent and stannic hydroxide was good; (4) antimonic anhydride and antimony tetroxide are better than the trioxide; (5) of various antimonates and stannates, only calcium antimonate proved an excellent opacifier, and zinc stannate was pretty good; (6) the process of mfg. a compd. affects its quality as opacifier, *e. g.*, the stannic oxides which have been manufd. by igniting meta-stannic acid, $SnO(OH)_2$, obtained by oxidizing metallic tin with nitric acid, at 670–1060°C have proved pretty good opacifiers while good ones have been obtained by heating it at 1100–1230° and at last excellent ones at 1280–1435°; (7) the oxides, silicates and phosphates of aluminium and magnesium deteriorate the lustre of enamels. S. KONDO

148. Marine blue pigment for enamelling. T. FUKUDO. *J. Jap. Cer. Assoc.*, **348**, 432–8(1921).—Marine blue color of enameled wares is usually produced in Japan by adding copper oxide to raw batches. Since various difficulties have been experienced by enamelers in such a method, its improvement is needful. A German pigment which is added at the mill in the manuf. of marine blue wares was analyzed with the result: 32.44% alumina, 4.64% silica, 1.28% magnesia and 0.60% moisture and loss on ignition; and a similar pigment made by heating a batch of 33 cobalt oxide, 24 chromic oxide, 35 alumina, 2 stannic oxide, 1 magnesia and 5 silica to cone 13 was almost as bright as the imported one. The shade of the pigment can be easily controlled. The effects of the introduction of various substances to the raw batch of pigment upon clarity of the color are described; in short, the addition of stannic oxide, antimony oxide or bone-ash makes the color clear, while zinc oxide, magnesia, lime and silica tend to make the color dark or gloomy. The most economical method is in the utilization of impure alumina which is obtained as residue in the process of extracting alum from calcined alunite; the alumina used in the expts. had 65.33% alumina, 28.50% silica, 2.46% sulphuric anhydride, 0.67% ferric oxide, 1.25% lime and 1.80% potash. A pigment, made by heating a mixt. of 55 impure alumina, 26.1 cobalt oxide and 18.9 chromic oxide to cone 13 or 15, was as excellent as that imported from Germany. In enameling, 2% of pigment is added at the mill. S. KONDO

PATENT

149. Enamel. WILLIAM A. BRIGGS. U. S. 1,409,919, March 21, 1922. A compn. enamel including 25 to 55 parts by wt. of copal gum, 5 to 35 parts by wt. of rosin, 10 to 40 parts by wt. of filling material, and 10 to 35 parts by wt. of oil. C. M. S., JR.

Cement, Lime and Plaster

150. Study of gypsum. K. KISHIMOTO. *J. Jap. Cer. Assoc.*, **357**, 201–16(1922).—The results of expts. in which 1 g. of a pure gypsum was heated in an elec. fur. at various temps. for different times, indicate that the mineral loses its water when it is heated at 90°C or higher, but the rate is very slow at 90°. Sol. anhydrite is strongly hygroscopic and changes readily to the hemihydrate in the atm. The hemihydrate takes moisture from the atmosphere; this phenomenon is merely due to physical adsorption. S. KONDO

151. Accelerated tests of Portland cement. S. KANO. *J. Ind. Chem.* (Tokio), **7**, 657–99(1921).—Hitherto proposed methods of the accelerated testing of Portland cement are described and discussed. Two Portland cements with following compns. were used throughout the study:

Cement	Insol. residue	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	Loss on ignition	Total
A.....	0.20	24.42	3.80	3.25	63.52	1.03	0.97	2.10	99.29
B.....	0.17	24.67	4.61	3.20	63.79	0.72	1.02	1.75	99.93

Thin pats of both cements stood the four-week cold-water test, but in boiling test of an hour and a half, the pats of B were badly cracked while those of A remained sound. To see the effect of heating the briquettes during their hardening on the strength of cement mortars, test pieces which have been allowed to remain in moist air for 24 hrs. were immersed in water of ordinary temp., and then the whole vessel was put in a larger tank contg. boiling water which brought the temp. of the water in the inner vessel to 97–98°C in about $1^1/_2$ hrs. Some of the results are given in the following tables:

TABLE I

		Cement A			Cement B		
		Tensile strength		Crushing strength	Tensile strength		Crushing strength
		Neat cement	Cement 1 Sand 3	Cement 1 Sand 3	Neat cement	Cement 1 Sand 3	Cement 1 Sand 3
Per cent of water used		14.5	7.5	7.8	14.5	7.0	7.5
Temp.	Age of hardening						
97–98°	1 day	32.3	11.0	48.0	..	..	...
97–98°	2 days	75.8	15.9	182.0	75.0	16.4	162.1
97–98°	3 days	84.1	20.3	234.0	86.8	19.8	217.0
97–98°	4 days	66.6	21.0	258.5	93.6	21.0	258.0
97–98°	5 days	72.1	22.0	278.5	77.8	21.9	270.0
97–98°	6 days	73.4	21.4	285.5	78.1	21.1	301.0
97–98°	7 days	77.1	23.1	302.5	76.1	22.5	303.0
8–18°	7 days	66.4	22.5	131.5	61.8	21.0	117.0
8–18°	28 days	68.9	30.3	196.5	65.9	29.0	181.0

Thus, the tensile strength of neat cement mortar, when it is hardened at high temperatures, gets to a maximum within three or four days and then falls rapidly. Similar phenomenon is also observable in cement-sand mortar, though it is by far feebler. Since such an irregularity does not occur in the crushing strength, its test is more reliable

than that of tensile strength. The expansion of these cements hardened at ordinary and high temperatures have been measured:

TABLE II

EXPANSION OF NEAT-CEMENT MORTAR, MEASURED WITH BAUSCHINGER'S APPARATUS, AT 15°C

	Cement A		Cement B	
	Hardened at ord. temp.	Hardened at high temp.	Hardened at ord. temp.	Hardened at high temp.
Time of hardening	0.0303%	0.0808%	0.0287%	0.1442%
3 days	0.0386	0.0832	0.0481	0.1570
7 days	0.0424	0.0674	0.0538	0.1468
14 days	0.0547	0.0694	0.0650	0.1468
21 days	0.0547	0.0694	0.0650	0.1468
28 days	0.0590	0.0688	0.0758	0.1504

The reason why cement B has failed in boiling test for soundness is clearly explained in the table. Besides these, the moisture and loss on ignition of test pieces, made in similar manner, have been determined. S. KONDO

152. Non-slip surfaces. ANON. *London Times Supp.* (Eng. Sec.), **10,** 173(1922).—Non-slip stair-treads, foot-paths, and railway platforms of silicon-carbide and fused bauxite of the Paris Metropolitan Railway have been surfaced with cement with silicon-carbide incorporated present a non-slip surface, show scarcely any signs of wear. The abrasive surface consists of not less than 1 lb. of granulated abrasive incorporated into each sq. ft. of the granolithic surface to the depth of $^1/_4$ in. The granolithic mortar placed to $^1/_4$ in. of the finished surface and into it troweled first a dryer consisting of 1 part abrasive material, 1 part sand, and 2 parts cement; followed by a second dryer consisting of 1 part abrasive material and 2 parts cement, troweled in until at least 1 lb. per sq. ft. of abrasive material is incorporated and the surface brought to proper level. O. P. R. O.

153. Manufacture of Portland cement. T. F. MILLER. *Chem. Trade Jour. and Chem. Eng.*, **130,** 71(1922).—Describes rotary grate shaft kiln. The perfect utilization of the ht. effects a saving of over 50% of the fuel used in the rotary kilns. They can be shut down for several days and started up again without difficulty enabling the closing of the works over week ends and holidays and in slack times. The power required is small in comparison with the rotary type, the grate itself taking from 2 to 3 h. p. The total does not exceed 18 to 20 h. p. including the briquetting press, the feeding device and fan. Descrip. and illus. given. O. P. R. O.

154. Light-weight concrete. ANON. *London Times Trade Supp.* (Eng. Sec.), **10,** 173(1922).—A memoir to the Académie des Sciences, Colonel Rabut, Inspecteur-General des Ponts et Chaussées, refers to exptl. researches on concrete made with slag of considerably lower sp. gr. than that of the gravel and broken stone. Slag concrete is generally stronger, though sometimes a little weaker, than gravel concrete, wt. 30 to 40% less than gravel concrete; ratio of strength to wt. attains max. with sand is from $^1/_4$ to $^1/_5$ that of slag used. Col. Rabut has constructed in slag concrete, the bridge carrying the station Asnieres and the Lestonnat Jetty in the port of Bordeaux. He has recently completed, in the arsenal of Lorient, a large jetty entirely in slag concrete, including piles 65 ft. 6 in. long by $15^3/_4$ in. square; he has constructed tank wagons and barges of the same material. O. P. R. O.

155. Artificial stones. ANON. *Gewerbefleiss,* **100,** 326–30(1921); *Chimie et industrie,* **7,** 944(1922).—The applications of magnesian (Sorel) cements are continually increasing on account of the great hardness and beautiful white color of the products made from them. Unfortunately, owing to premature setting in contact with moist

air, they can not be stored for any length of time or shipped. This drawback can be overcome by mixing $BaCl_2$ with the $MgCl_2$, and adding enough $MgSO_4$; so that in the presence of moisture the $BaCl_2$ and $MgSO_4$ yield Mg oxychloride and finally pure MgO. The resulting cement is still of a fine white color and can set with suitable amt. of aggregate. The author describes various processes for obtaining fine imitation marbles by using metal chlorides mixed with $MgCl_2$ instead of colored metal oxides. Similarly, natural stones can be given a mottled appearance by injections in the capillary fissures of the rock. A. P.-C. (*C. A.*)

156. Improved continuous-operation pot lime kiln. C. L. NORTH. *Rock Products*, **25**, No. 3, 47–8(1922).—Mostly mechanical. The main point of interest is in the use of a cone-shaped interior of the kiln rather than the usual kiln constructed with Dutch ovens on two or more sides. A diagram and the advantages of this cone-shaped kiln are given in detail. E. F. PERKINS (*C. A.*)

157. Process of improving the quality of mason's hydrated lime. FRANCIS C. WELCH. U. S. 1,410,087, March 21, 1922. The process of increasing the plasticity of mason's hydrated lime, which comprises the grinding of the mason's hydrated lime in contact with a drying agent. C. M. S., JR.

158. Method of calcining gypsum rock and the like. CHARLES R. BIRDSEY. U. S. 1,412,203, April 11, 1922. The method of mfg. gypsum products of different hygroscopic natures by a continuous operation which consists in calcining the crushed raw material, then sepg. the fine material from the coarse, the fine material providing a product of one hygroscopic nature, and finally grinding the coarse material to provide a product of a different hygroscopic nature. C. M. S., JR.

159. Plastic building construction. CHARLES B. SEIDLE. U. S. 1,409,246, March 14, 1922. In a building construction, a vertical double wall, including outer and inner sections affording an air space therebetween, the inner section being formed of horizontal layers of assembled blocks, horizontal plastic beams resting upon the top of the blocks in a selected horizontal layer and terminating substantially flush with the wall of the air space to leave such space substantially unobstructed, filler blocks arranged upon the top of the blocks in the same horizontal layer and disposed upon opposite side of the beams, floor slabs resting upon the filler blocks and terminating substantially flush with the wall of the air space to leave the same substantially unobstructed, and means for locking the floor slabs with the plastic beams, the blocks above the beams and floor slabs resting upon the floor slabs and beams. C. M. S., JR.

160. Wall covering or putty containing magnesium oxychloride. K. WOLF. U. S. 1,418,896, June 6. "Condensed" magnesite is heated to a low glowing temp., slaked after cooling, calcined and mixed with $MgCl_2$ soln. (*C. A.*)

161. Mortar and building-block composition. J. J. LEMON. U. S. 1,418,810, June 6. Ground yellow or white blast-furnace slag 7, sand 1, cement 1, lime 0.07 part and sufficient H_2O to form a moldable plastic compn. (*C. A.*)

162. Plaster mixture. W. T. FELS. U. S. 1,419,665, June 13. A mixt. of ashes 60, plaster of Paris 30, lime 9 and glue 1% is used for finishing walls. (*C. A.*)

163. Composition for building-blocks. F. PATEE. U. S. 1,418,160, May 30. Asbestos aggregate 5–7, portland cement 1, $Ca(OH)_2$ 0.1–0.2 parts are mixed with H_2O and molded. (*C. A.*)

164. Waterproofing cement compositions. G. H. HAVENS. U. S. 1,418,374, June 6. A mixt. contg. hydraulic cement, hydrated lime, slippery-elm bark, alum and $CuSO_4$ is used for building purposes. (*C. A.*)

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General and Miscellaneous

1. **Continuous kilns for pottery manufacture.** ANON. *Brick Pot. Trade Jour.*, **30**, 205(1922).—The employment of continuous kilns for firing pottery has in some cases failed because the potters insist on burning colors in them—which is only practical in single ovens. Continuous kilns of the Hoffmann type have not been used to any great extent for domestic pottery, but have proved satisfactory for sanitary ware. There is no reason why they should not be used for whiteware. Tunnel ovens or car-kilns are suitable for whiteware but can only be used for a limited number of colors. The initial cost would be prohibitive for works with a small output but remunerative for a sufficiently large plant. The tunnel kiln can be filled more efficiently, which saving together with a reduction of cost of saggers and fuel favors this type of kiln. The tunnel oven has a small variation in output and in this respect is inferior to the continuous compartment kiln which can if the need arises be worked as a series of separate compartments. H. G. SCHURECHT

2. **The business situation and outlook.** ANON. *N. J. Ceramist*, **1** [2], 97–108 (1921).—A symposium of views of various business men regarding the business outlook, with particular reference to the clay products industry. C. W. PARMELEE

3. **Symposium on gas firing. II.** E. W. SMITH. *Trans. Ceram. Soc.* (Eng.), **21**, 189–207(1922).—In the Dayton system of vaporizing oil used in the U. S., four gallons of fuel oil give 1000 cu. ft. of gas having a calorific value of 450 B. t. u. M. W. TRAVERS. —In an investigation of direct fired coal furnace by the U. S. Bureau of Mines, it was shown that in every case the whole of the oxygen had disappeared before it had risen four inches from the fire bars, and that in every case the gas which came from the top was what might be called a fair producer gas. Every so-called direct-fired commercial furnace is actually a gas producer, in which the gas is sometimes burned by secondary

air, but very often is not burned. We should discard the word "direct-fired" and regard all coal fires as producer systems, in which the fuel is more or less efficiently gasified, and in which, above the fuel bed, the gases are more or less efficiently burned. Producer gas can be burned with cold secondary air. Preheating the air usually furnishes the only method of getting it into the furnace. When the furnaces are not furnished with recuperators, the air can be injected by means of a fan. The total efficiency of the recuperative furnaces is much higher than that of the non-recuperative furnaces, but the difference has nothing to do with the difficulty of burning the gas with cold air, for no difficulty has been experienced. The fact that furnace builders regarded the problem of introducing secondary air into furnaces as one involving statics rather than dynamics has been the cause of failure of many furnaces. One has not merely to consider whether air would flow through the channels in a certain direction, but whether the rate of flow will be sufficient to provide for the complete combustion of the gas. Lt.-Col. C. W. Thomas.—Whatever economies there are in gas firing will be found to result not from a mere change over in system from using solid fuel in a fire hole to gas from a producer, but the problem will resolve itself into a question as to whether or not recuperation is used in heating. In a continuous kiln, whatever may be the type of firing, recuperation always is employed. Attention should be given to the insulation of kilns. H. F. S.

4. Combustion of fuel oil; with a description of an oil-gas furnace. Percival J. Woolf. *Trans. Ceram. Soc.* (Eng.), **21,** 161–88(1922).—Experiments carried out with some fuel-oils indicate that below 200°C, the quantity that is vaporized is negligible, and that between 200°C and 300°C, only a small portion of the fuel-oil can be vaporized. When raised to a temp. of over 300°C the fuel-oil commences to vaporize more extensively, and when 400°C is reached it is substantially vaporized. At 450°C it has been found that it is completely vaporized except for a minute quantity of solid, this quantity being under 1%. To eliminate the excess air in burning oil, and at the same time obtain perfect combustion within the furnace proper, without increasing the size of the furnace or adding to it in the way of combustion chambers, the vaporization and mixing of the oil and air, prior to the entrance into the furnace, has been accomplished according to Woolf by the Sklovsky U. S. Patent No. 1,229,338. In this case the air is supplied under pressure, is forced through heating chambers which utilize the heat from the incoming gases, and is further forced from the heating chambers through a vaporizing chamber. Through the inlet the necessary fuel oil is supplied into the latter chamber, the oil being introduced into a stream of heated air; it passes through the vaporizer, together with the air, from which it absorbs the heat. By the time the exit of the vaporizer is reached the oil is completely vaporized and intimately mixed with the air, from which point it is conducted through a tube directly into the combustion chamber of the furnace. In this patent the air is maintained at not less than 300° and not over 400°C. Preferably the air should be 350 to 400°C. A description is given of the car tunnel kiln built at the plant of the Lennox Pottery Co., in Trenton, N. J., and arranged for firing with vaporized oil. It is a twin chamber furnace in which the stock progresses through the two chambers in opposite directions. The treating zone is near the center; thus a single source of heat supplies both chambers, and the entering cold stock is preheated by the treated stock enroute to the exit. The efficiency of this heat transfer is dependent upon the natural convection currents set up in the inert atmosphere of the furnace by the heat radiated by the charge. H. F. S.

5. The Marlow gas-fired tunnel oven. J. H. Marlow. *Trans. Ceram. Soc.* (Eng.), **21,** 153–60(1922).—A detailed description with drawings of a car tunnel oven fired with producer gas. The air for combustion passes in flues from the receiving end of the kiln through the firing zone and then to the burners. H. F. S.

6. **The new ceramic station at Rutgers College, State University of New Jersey.** ANON. *N. J. Ceramist*, 1 [2], 109–12(1921).—A brief statement regarding the plans for the erection of a building. C. W. PARMELEE

7. **Tariff revision and regulation.** WILLIAM BURGESS. *N. J. Ceramist*, 1, 80–7, June(1921).—A discussion of the revision of the tariff with special reference to clay products. C. W. PARMELEE

8. **Oil burning in a ceramic plant.** R. L. CLARE. *N. J. Ceramist*, 1 [2], 126–30 (1921).—The author discusses oil burning under the following headings: The adaptation of fire box; the equipment required; comparison of relative costs of oil and coal. He finds that 150 gals. of oil will do the same work as a ton of coal in kiln practice, and better than that. At 5c. a gal. the relative cost of oil is $7.50, coal cost $6.00. He is of the opinion that this cost can be reduced by careful firing. The higher cost of oil is offset in a large degree by the fact that with oil there is a reduction in the amount of kiln labor necessary, also neither coal nor ashes have to be handled. C. W. P.

9. **The Hardinge conical mill in the ceramic industry.** HARLOWE HARDINGE. *N. J. Ceramist*, 1 [2], 137–44(1921).—There are two types, the conical ball mill and the conical pebble mill. The ball mill is used either for wet or dry grinding, and usually where the feed is comparatively coarse, that is, up to 2", and where a slight iron contamination of approx. .05% will not be detrimental to the product. The pebble mill is used principally where this contamination is objectionable. By the use of the conical shape there is a segregating effect which occurs within the mill which permits of the use of a coarse feed, and the delivery of a fine product in one unit, and at the same time maintaining a high capacity for the power consumption. This shape also enables the mill to withstand shock and prevents undue wear of the lining. Also, the mill is extremely rigid in construction. *Feldspar grinding.*—A typical installation is a conical pebble mill 5 ft. in diameter. When operated in conjunction with a vibrating screen, for obtaining a fine product, the mill is capable of delivering a finished product in one operation. The product is approx. 90% through 100-mesh. An 8′ 30″ conical pebble mill requires 40 to 50 h. p. to operate, and has a capacity on ordinary feldspar grinding to 90% through 100-mesh, of $2^1/_2$ T. per hour, the repair costs averaging below 4 c. per ton over a period of 8 yrs. For the finer grinding of feldspar, that is, for a fineness of less than 1% on 140-mesh or 98% through 200-mesh, it has been found best to use two mills. The use of an air separator in conjunction with this mill not only gives a product of the proper fineness, but actually aids the operation of the mill. *Silica grinding.*—A 6′ by 48″ Hardinge pebble mill, requires approx. 30 h. p. operating in conjunction with an air separator, has a capacity of 1 T. per hr. the feed being 3/4″ and the product 90% passing a 200-mesh screen. The mill grinds with a minimum of fineness and when sharp corners must be retained on the particles discharged. C. W. P.

10. **Description of a tunnel kiln in Czecho-Slovakia.** H. BARKBY. *Trans. Ceram. Soc.* (Eng.), 21, 277–88(1922).—This is a Faugeron kiln firing porcelain to cone 14. The compn. of the body is: China clay, 40; flint, 30; feldspar, 30. The glaze is composed of the body mixt. plus lime, part of the china clay being first calcined. The clay ware is fired first to about 950°C in a tunnel kiln similar to the one described, after which it is dipped and both body and glaze matured at cone 14. The total length of the oven is 60 m. (196 ft.), with a fireplace on either side at the middle. The width of the inside is about 1.25 m. (4 ft.), and the length from the rails to the vault roughly 3 m. (10 ft.). Below the level of the rails is an inspection passage large enough for a man to walk down. It is almost the full length of the tunnel, with entrances at several convenient points to enable the attendants to pass from one side to the other without having to walk around the tunnel. At the entrance to the tunnel is situated the motor which drives the fan for drawing gases to the chimney and also which pushes the trucks

through. On the exit side of the fireplaces are 2 secondary air channels which conduct the heated air from the cooling goods to the fireplaces. The trucks measure 2 m. (6.5 ft.) long by 1.25 m. (4 ft.) wide. Immediately above the wheels is a platform made by strong sheets of iron with the sides turned down for a couple or 3 in. These iron lips are for the purpose of the sand seal. On this iron platform is built a solid bed of fire-clay bricks approx. 9 in. thick, to protect the iron and to insulate the oven. A groove runs along each side of this brickwork and into this fits a rib which runs the whole length of the tunnel. Above this solid bed of fire-clay bricks are arranged fire-clay studs similar in shape to a cotton bobbin, only much larger, being about 10 in. high. When these studs are placed side by side flues are formed both lengthways and crossways of the truck with gaps in the upper surface. The studs on either side are a little different in shape on the upper surface, so as to give a fairly straight edge to the truck. On this layer of studs are placed the saggars, containing the ware to be fired, to a height of 2 m. (6.5 ft.) and then above and across them are put fire-clay baffles. This completes the loading of the truck, but before it is sent into the tunnel it is passed under a loading gauge similar to those used on the railway to see if it is over or under loaded. Although air locks are provided at the entrance and exit, they were not being used. The saggars and fire-clay baffles fit so close to the walls and roof of the tunnel that they are not needed. The gases, on leaving the tunnel, are at a temperature not higher than 300 to 350°C and are used for heating a greenware house and storerooms before going into the chimney. The goods as they leave the tunnel are cool enough to handle. The saggars are thinner than those in common use here and are machine made. The underneath surface of the saggar is concave, which it is claimed, gives strength with lightness. The tunnel holds 30 trucks, and a truck travels from one end to the other in 36 hrs. In 24 hrs. the output is almost equal to one 18-ft. round oven. The coal consumption per day is about $2^1/_2$ to 3 T. of local brown coal. As they are firing porcelain, it is necessary to have a reducing atmosphere, and they "smoke" for $^2/_3$ of the distance from the fireplaces to the entrance. Repairs are very small. Only once a year is it necessary to attend to the fire boxes. The under carriages which were put into use 12 to 16 yrs. ago are still running without having been repaired. The following kilns are in use on the Continent: For earthenware industry 9 kilns; for porcelain 7 kilns, with 3 being built; for fire-bricks 2 kilns; for wall tiles 1 kiln, with 1 being built. In the discussion, doubt was expressed by several potters as to whether the drop arches and clay baffles produced an up-and-down flame of gases in the Faugeron kiln. H. F. S.

11. Surface combustion and the possibility of its adaptation to the ceramic industry. W. STEGER. *Trans. Ger. Ceram. Soc.*, **2**, 83(1921).—Surface combustion will probably find application first for heating muffle or tunnel kilns. The burning of limestone, dolomite, magnesite, etc. can be carried on economically by this method as high temperatures can be reached with a comparatively poor gas seeing that combustion takes place in the restricted space between the fragments of the charge. The suggestion is made that this firing method would find successful application in the burning of the Dressler tunnel kiln if the hollow interior lining of the fire zone were filled with suitable refractory fragments and the gas was drawn through this mass under a slight vacuum. The research laboratory of the State Porcelain Works, Berlin, has installed several miniature kilns of this type for further study. F. WHITAKER

12. Soap making possibilities in china-clay. ANON. *The London Times Trade Supplement*, **101**, 457(Aug. 19, 1922).—Expts. have been proceeding for some time which have for their object the developing from china-clay, a colloidal clay as an integral part of soap. As it supersedes the fats and oils usually employed in the making of soap, it is claimed that it will produce a cheaper soap and create a new demand for china-clay. The expts. also show that it is possible to make a colloidal clay soap directly from either

(1) an oil or fat or (2) a mixt. of fatty acids, the soap produced having similar properties to that made by incorporating the colloidal clay after the soap has been made. The greatest value of the direct method of prepg. a colloidal clay soap lies in the saving of time required for saponification. Other advantages over ordinary soap that colloidal clay soap is said to possess are: (1) It is more sol. in water and produces a lather quicker. (2) It is ready for use sooner after manuf. than ordinary soap and dries quickly; does not become too dry by long keeping. (3) It is less likely to contain free fatty acids or free alkali; the quantities of reacting material can be more easily adjusted, and any slight excess of alkali is counteracted by the absorbent power of the colloidal clay. (4) It improves greatly in quality on aging, whereas soap alone generally deteriorates after 18 mo. or so. Mr. F. E. Weston, one of several industrial chemists who have been carrying out expts. states that it cannot be maintained that colloidal clay is only playing the part of a "filler;" it is more in harmony with exptl. fact to term it "an active principal." The china-clay producers are alive to the possibilities of this new outlet for china-clay, and some of them are either producing colloidal clay or are prepg. to do so. O. P. R. O.

13. Fuel economy and production expenses. Allen M. Perry. *Elec. World*, **80**, 115–8(1922).—Data are given for elec. plants burning coal, oil, gas and hogged fuel. Careful analysis of data permits interesting comparisons between the results obtained. Today some of the plants are getting back to a net station cost of about $0.01 per kw.-hr. C. G. F. (*C. A.*)

14. The practical economization of coal fuel and the responsibility for it. W. E. Appleby. *Commonwealth Eng.*, **9**, 396–404(1922).—A discussion of the principles of fuel saving in boiler plants, presenting charts and formulas for computing losses from CO_2 recorder readings, and the saving effected by economizers. E. W. Thiele (*C. A.*)

15. Waste-heat boilers in steel plants. J. C. Hayes. *Blast Furnace and Steel Plant*, **10**, 355–6(1922).—The installation of waste-heat boilers in steel plants is becoming more and more important. In most modern plants the boilers are either being placed or space is left for their later installation. A boiler for this purpose is differently arranged from the firing type, because ordinarily the larger part of the heat transmitted into the boiler water is from radiation; this is usually absent in waste gases. The boiler must, therefore, be arranged so that the gases have greater contact with the boiler surfaces in order to prevent the stagnant film of gas from being present. An ordinary 75-ton open-hearth furnace is capable of yielding power equal to 350 boiler h. p. per hr. in steam of 160 lbs. pressure and 100° superheat. W. A. Mueller (*C. A.*)

16. Keeping down the furnace losses. R. T. Haslam. *Power*, **55**, 372–5(1922).—A certain amt. of excess air is necessary for most economical operation of a boiler. Charts are shown wherefrom the correct amt. of excess air may be calcd. after analyzing the flue gases with an Orsat app. and detg. the stack temp. D. B. Dill (*C. A.*)

17. Low ash coal not always desirable. S. W. Flagg. *Power*, **55**, 328–30(1922).—A high-grade coal with 4.30% ash gave considerable trouble when used in an automatic stoker. The tops of the grate bars reached a dark red to cherry-red temp. and serious damage to the bars resulted. Expt. proved that the lack of ash in the coal prevented the formation of a heat-insulating layer of ash over the bars. The substitution of a high-ash coal solved the problem. D. B. Dill (*C. A.*)

18. The economical production and use of steam. J. R. Hannan. *J. Textile Inst.*, **13**, 95–100(1922).—A comparison of the coal-fired and the oil-fired boiler. An argument is advanced in favor of a condensing unit in a plant which uses process steam. L. A. P. (*C. A.*)

19. Some suggestions concerning the college education of an engineer. Carl Hering. *J. Am. Inst. Elec. Eng.*, **41**, 415–7(1922). B. G. Lamme. *Ibid.*, 406–9.

S. E. Doane. *Ibid.*, 409–11. Philip Torchio. *Ibid.*, 412–3. Taliafero Milton. *Ibid.*, 606–9. L. A. Ferguson. *Ibid.*, 570–1. C. G. F. (*C. A.*)

20. Industrial electric heating. W. S. Scott. *Elec. J.*, **19**, 203–8(1922).—Modern elec. furnaces and ovens for annealing, hardening, tempering, drying, baking, enameling, glass and ceramics are briefly considered. In the appendix 21 examples of various heating processes are cited with detailed operating data. C. G. F. (*C. A.*)

PATENTS

21. Kiln with heating chambers and cooling chambers. Victor Gelpke. Luzern, Switzerland. 1,426,287, Aug. 15, 1922. A kiln, comprising, in combination, a furnace, a heating-chamber, a cooling chamber, and a compensating-member arranged between the chambers; the member consisting of two sheet-metal plates arranged at an appropriate distance one from the other, and gas-tight connections between the plates, as well as between them and the structure-components with which they are connected. C. M. S., Jr.

22. Plastic composition and articles formed therefrom. James P. A. McCoy. U. S. 1,425,784, Aug. 8, 1922. An insulating compn. comprising bakelite mixed with a polymerizable resin. C. M. S., Jr.

23. Burning ceramic wares and apparatus therefor. Taine G. McDougal. U. S. 1,416,726, May 23, 1922. That improvement in the art of burning ceramic wares which consists in continuously passing the wares through a kiln having a preheating zone, a high-temperature zone and a cooling zone, and maintaining the wares openly exposed to radiation from the under surface of the ceiling of the kiln in the high-temperature zone for a period sufficient to insure thorough burning throughout the whole mass of the wares, the under surface being intensely heated by combustion in the space between it and the wares. C. M. S., Jr.

24. Tunnel kiln. Ellsworth P. Ogden. U. S. 1,418,669, June 6, 1922. A tunnel kiln provided with a main stack or fan and also having an auxiliary stack or fan independent thereof by which special bases and vapors which have been introduced into the kiln for special purposes may be removed therefrom without resort being had to the means for inducing the main draft. C. M. S., Jr.

25. Burning ceramic wares. Taine G. McDougal. U. S. 1,416,727, May 23, 1922. In a continuous kiln for burning ceramic wares, a thin highly refractory carrier forming the support for the wares, supporting means on which the carrier travels through the kiln, the space about the supporting means being filled in with heat insulating material to a level close up to the lower side of the carrier, the supporting means including a highly refractory element projecting through the floor of the kiln on which the carrier directly rests and with reference to which the carrier is movable. C. M. S., Jr.

26. Gas-fired pottery kiln. Arthur McDougall. London. 1,423,408, July 18, 1922. A gas-fired rectangular kiln for burning argillaceous ware, a gas bag therein constructed independently of the brickwork of the kiln, the gas bag dividing the kiln into a plurality of compartments, the bag having constricted apertures in the sides and top whereby heating gases escaping from the bag are evenly distributed and traverse the ware contained in the kiln between the bag and the walls of the kiln, the bulk of the gas passing through the ware in a horizontal direction. C. M. S., Jr.

27. Weatherproofing clay. W. H. Allen. U. S. 1,421,888, July 4. The capillarity of the surface of an unbaked clay article is destroyed by pptg. Ca silicate in its interstices. (*C. A.*)

Apparatus and Instruments

28. Disappearing filament optical pyrometer free from diffraction effects at the filament. C. O. Fairchild. *Phys. Rev.*, **18**, 116–8(1921); *Science Abstracts*, **23A**, 224. H. G. (*C. A.*)

29. **The use of commercial viscosimeters.** H. Gault and L. Boisselet. *Mat. grasses*, **14**, 6185(1922).—In a particular instance an Engler-type viscosimeter gave a viscosity at 50° for a machine oil 1° Engler lower than a standard instrument. This was traced to the fact that the capacity of the chamber in the first instrument was 8 cc. too great, causing an increase in head. This did not appreciably affect the rate of flow of water at the temp. of standardization, but increased that of the oil at 50°.

A. P.-C. (*C. A.*)

30. **Note on pipettes.** Verney Stott. *J. Soc. Glass Tech.*, **20**, 307–25(1921).—A collection of data on the variation of the volume delivered by pipettes of capacity 2 to 100 cc. with the delivery and drainage time. Class A pipettes should be adjusted for a particular delivery time which should lie between certain limits, depending on the capacity, and a definite time should be allowed for drainage when graduating, testing, or using them.

G. S. Fulcher

31. **Pyrometer possibilities.** Walter A. Hull. *N. J. Ceramist*, **1** [2], 113–6 (1921).—Brief article outlining the function of pyrometers and their value as a permanent investment.

C. W. Parmelee

Chemistry, Physics and Geology

32. **Asbestos in the Union of South Africa.** A. L. Hall. *Union of S. A. Dept. of Mines and Industries, Memoir*, **12**(1918).—The Union of S. Africa contains large asbestos deposits and holds the world's record for varieties of fibre. In areal extent the crocidolite belt of the Cape Province is the largest asbestos area of any kind hitherto recorded. The fibre varieties comprise the following, named in order of abundance: (1) *crocidolite*, (2) *amosite*, (3) *chrysotile*, (4) *tremolite*. These varieties are distributed thus: (1) the Cape, crocidolite, (2) the Transvaal, crocidolite, amosite, tremolite, and chrysotile, (3) in Natal, chrysotile and tremolite. The Free State has not so far furnished any asbestos deposits. Crocidolite or "Cape blue" is the best-known variety in the Union; its occurrences having been exploited without interruption since 1892. The crocidolite belt in the Cape measures some 250 mi. in length, with a max. width of over 30 mi.; this distribution consists of a great thickness on thinly-bedded ferruginous siliceous slates or banded ironstone, to which the crocidolite is confined in the form of many strictly interbedded cross-fibre seams, ranging from the max. of 5″ downwards; most of the seams consist of lavender blue fibre from $^1/_4$″ to 1″ in length. In the Transvaal crocidolite interbedded cross-fibre seams occur in the basal portion of the Pretoria Series close to the underlying dolomite, in ferruginous siliceous slates practically indistinguishable from banded ironstones, and consist of the same lavender-blue fibre as in the Cape belt. Their exploitation is still in the initial stages. Amosite has so far been found in the Transvaal only. It forms a new variety of asbestos as a monoclinic ferrous silicate amphibole with or without soda. Amosite is an ash-gray or pale brownish mineral, occurring as interbedded cross-fibre seams in the same banded ironstones of the basal portion of the Pretoria Series (close to the underlying dolomite) in which crocidolite is found. The length ranges from the not uncommon value of 11″ downwards; very frequently from 4″ to 7″ wide over considerable distance. Chrysotile forms a commercial occurrence in the Transvaal only. This asbestos forms cross-fibre seams interbedded in altered dolomite and ranging from the very rare maximum of 7″ downwards. Seams of $^1/_2$″ in thickness are common. The Natal chrysotile is found in cross-fibre seams in dark greenish serpentine and disposed vertically along and very close to the contact with an aplite intrusion. These deposits appear closely analagous to the Canadian type of deposit. The present economic situation makes the establishment of local mfg. industry of asbestos goods very welcome. Such factories exist, in which crocidolite, amosite, or tremolite (with its country rock of talc) are

adapted to various uses; among these, the requirements of the building material and engineering trades claim first attention, *e. g.*, roofing tiles, flooring, coiler lagging, etc. The suitability of Cape blue for the manuf. of goods requiring spun fibre has long been well established, and recent expts. carried out under proper technical conditions have demonstrated that amosite can also be fiberized and adapted for yarn production. This memoir contains analyses of asbestos, a bibliography on the subject; also maps and plates. O. P. R. O.

33. Neutral salt. ANON. *Raw Materials Rev.* (London), **1**, 167(1922).—With the development of the production of synthetic ammonium sulphate, it is reported that sulphate fertilizer, which has always contained an excess of acid, is now giving way to the neutral ammonium sulphate. It is predicted that within the next 2 yrs. it will have become impossible to sell the acid-contg. product. There are many processes whereby acid-contg. ammonium sulphate may be converted into the neutral product, or whereby the natural product can be made directly. These processes may be classified as follows: (1) Washing or spraying processes: (*a*) With atomized water; (*b*) with treated mother liquor; (*c*) with weak solns. of ammonia obtained in various ways. (2) Treatment with gaseous ammonia under a moderate pressure. (3) Incorporating a neutralizing agent in solid form. (4) Production of neutral ammonium sulphate within the saturator or saturators. The production of the neutral salt entails careful chem. control, and the process requires supervision by trained men. At the present time the importance of this new development in the sulphate industry is, perhaps, of moment to the English fertilizer industry only. It is believed, however, that before long its significance will apply to other countries as well, for it is contended that the neutral ammonium sulphate is more effective as a fertilizer than the acid salt. O. P. R. O.

34. Rhodesia asbestos. ANON. *Raw Materials Rev.* (London), **1**, 143(1922).—The 1921 output of Rhodesia asbestos was valued at £795,699, as against £5,224 in 1913. It should be noted that Rhodesia is second only to Canada in the production of asbestos. O. P. R. O.

35. Fluorspar in Prussia. ANON. *Raw Materials Rev.* (London), **1**, 155(1922).—Fluorspar, or calcium fluoride, is the only material which is used in Prussia for the production of hydrofluoric acid. It is used also in certain metallurgical processes, such as in the smelting of roasted copper ore, and, as long as it remains cheap enough, in the iron works. Colorless fluorspar has also been used for optical purposes. Fluorspar is found only in gangue, and therefore is frequently with iron. The occurrence of fluorspar in Germany is very frequent, although mostly in small volume. It is produced at Uftrugen, and in the Claustaal. O. P. R. O.

36. The reversible thermal expansion of silica. H. S. HOULDSWORTH AND J. W. COBB. *Trans. Ceram. Soc.* (Eng.), **21**, 227–76(1922).—The reversible linear expansions of various forms of silica, raw and manufd. were detd., and along with them permanent changes in sp. gr. and refractive index. Pure amorphous pptd. silica underwent no change at 700°C even on prolonged heating, but after heating at 1170°C or cone 14, showed the great expansion between 200 and 300°C, characteristic of cristobalite (with a little tridymite). Pptd. silica contg. 5% soda showed the cristobalite expansion between 200 and 300°C after heating at 700°C, but heating at 1170°C, or at cone 14 gave the smaller (tridymite) expansion between 100 and 170°C and some cristobalite. The presence of the soda was apparently responsible for the formation of cristobalite at a lower temp., and for the formation of tridymite. Silica glass (vitreosil) gave very little thermal expansion but the refractive index corresponded with the formation of tridymite, to a small extent at cone 14 and to a considerable extent at cone 20. Quartz was not formed from amorphous silica in any of the above expts. Meanwood ganister with lime bond showed no cristobalite after a works burn to cone 9 but a little

cristobalite along with quartz after a lab. burn to cone 14, and more cristobalite at cone 19. Repeated works firing at cone 9, however, gave a little cristobalite even without bond. Welsh quartzite with lime bond transformed more easily. It gave a little cristobalite in the quartz at cone 9 (works burn), more at cone 14, and all cristobalite at cone 20. Flint with lime bond transformed more easily still. It gave some cristobalite at cone 9, nearly all at cone 14, and all at cone 20. None of these raw materials gave tridymite in any quantity. All of them underwent a considerable permanent linear expansion in the lower temp. ranges before any conversion of quartz occurred. The true sp. gr. and refractive index were not altered thereby but the porosity increased. The amount of the change differed in the three materials. (*a*) From Welsh quartzite, fired at cone 16. This brick showed the large cristobalite expansion between 200 and 300°C, and also some quartz expansion between 500 and 600°C. (*b*) From Yorkshire quartzitic pebbles. This brick showed the α to β cristobalite expansion, but no α to β quartz expansion between 500 and 600°C. A little tridymite may have been present. Silica bricks (from Welsh quartzite) after long use. (*a*) In coke oven (maximum temperature 1450°C). The innermost exposed layer was an impure glass with a steady expansion but only half as large between 15 and 1000°C as that of the layers behind, which will make for shelling away. The rest of the brick was all cristobalite with very little quartz or tridymite. Examn. of commercial silica bricks and used bricks from coke ovens and steel furnace roofs showed that the exposure to high temp. had evidently completed the change from quartz to cristobalite which had been largely effected in the kiln during manuf. Little or no tridymite was found. The vol. changes in manuf. and use of a silica brick may therefore be traced thus: First, on burning, the quartz undergoes a permanent linear expansion, with little or no decrease in specific gravity but an increase in porosity. This permanent expansion may be about one-half per cent even below 1000°C and considerably more at cone 9. The toughness may appreciably alter in consequence. The further burning to cone 14–16 alters the expansion curve, changing the quartz completely or partially, according to the nature of the raw material and the time and temp. of burning, into cristobalite. This means that the sudden α- to β-quartz expansion between 500 and 600°C is replaced by the α- to β-cristobalite expansion between 200 and 300°C. The total reversible expansion is not lessened. The furnace of "cristobalite" bricks is therefore much less subject to expansion strain at dull redness than one of "quartz" bricks, although more so below 300°C. Neither is at all sensitive above 600°C. Long exposure in use at high temp. completes the conversion of quartz to cristobalite. Apart from actual test in the expansion apparatus, the authors have found that a detn. of the true sp. gr. of the powdered brick is the best guide to its behavior as regards expansion and contraction. In the discussion it was claimed (by Arthur Acton) that the detn. of the true sp. gr. of the powdered brick is a guide to the possible vol. changes in the brick during its use, but only in so far as bricks of about the same lime content are being compared. Comparison of powder densities of bricks with 1.5, 2.0, 3.0 and 5.0% of lime indicate that with high lime content powder densities as low as 2.30 are compatible with the presence of unchanged quartz. H. F. S.

37. China clay. St. Austell. *Quarry & Surv. & Contractors' Jour.*, **27**, 290 (1922).—The lessening of dependence upon manual labor is discussed. Before the war a few works had introduced hydraulic hoses for washing the clay, it being found that the enormous pressure of water obtainable by this method was sufficient to wash the clay without the aid of men to break it up first. Various methods of removing overburden, and shaft and tunnel working. No new methods described. O. P. R. O.

38. Clay in India. L. L. Fermor. *Geol. Surv. of India: Records*, **53**, 256(1922).—In Rajmahal hills there are valuable deposits both of china-clay and of fire clay. The

china-clay occurs in 3 ways, *viz.*, (*a*) as the decompn. product of feldspar in the fundamental gneisses and schists; (*b*) in the white Damuda sandstone, where its presence is due to the decomposition of feldspar originally present in the sandstone, and (*c*) as beds of white china-clay interbedded with white Damuda sandstone. The principal bed of kaolin of the first mode of occurrence is 40–100 ft. thick. In the second mode of occurrence the china-clay is extracted from the sandstone by crushing, washing and settling; the china-clays of the second and third occurrence are used by the Calcutta Pottery Works. In addition, fire clays are found in beds ranging from 1 to 15 ft. thick in numerous localities in coal fields. O. P. R. O.

39. Kaolin deposits in Finland. Anon. *Jour. Royal Soc. Arts*, **70**, 526(1922).—Investigations concerning the extent of kaolin deposits in Finland show very favorable results. The deposits are 4 to 6 m. deep; in some places the stratification is over 10 m. deep, and it has been noticed that the deeper stratification furnished the better kaolin. According to German experts, this kaolin is of excellent quality, clearer and better than elsewhere in Europe; and the china made from it is entirely white. O. P. R. O.

40. Ferro-silicon from feldspar. Editorial. *Iron & Steel of Canada*, **5**, 154 (1922).—Potash of feldspar has been made available for human use in Sweden. Most of the processes have failed because they aimed at the recovery of the potash in the mineral, which is at best but 13 or 14% of its bulk. A commercially pure potash feldspar will contain 65% silica, 18% alumina and 13% potash, the remainder being mainly soda. J. E. Johnson, Jr., in 1920 applied for U. S. patents that described the manuf. in the elec. furnace of ferro-silicon from potash feldspar and scrap iron, the potash to be volatilized by the extreme temp. of the furnace and the fume caught and condensed. The Swedish process is similar, but simpler. Ferro-silicon is made from the same ingredients, but the potash is not volatilized and remains in the slag in combination with the alumina and other slag-making ingredients of the charge. This slag, from which the potash is readily dissolved, is ground and applied directly to the fields as fertilizer, presenting an excellent opportunity to Canadian manuf. of ferro-silicon. The large bodies of potash feldspar readily accessible and the cheap hydro-elec. power available for manuf. would point the way for one more Canadian industry. O. P. R. O.

41. The clays of Mercer County. Samuel M. Sharkey. *N. J. Ceramist*, **1** [2], 131–6(1921).—A brief description of the important clay areas in New Jersey, with particular reference to Mercer County deposits and their uses. C. W. Parmelee

42. Specific gravity and refraction of the potash-soda-feldspars. D. Byelvankin. *Bull. Petrograd Polytech. Inst.*, **24**, 437–52(1915); *Mineralog. Abstracts*, **1**, 89–90.—Analyses of K-Na feldspars from the literature showed no relations between compn., sp. gr.,

	I	II	III	IV
SiO_2	64.00	65.33	63.67	66.46
Al_2O_3	19.25	18.82	19.60	18.89
Fe_2O_3	....	....	....	0.75
BaO	0.41	....	0.98	....
CaO	0.15	0.39	0.40	0.61
Na_2O	1.86	4.23	3.62	7.68
K_2O	14.01	10.20	11.16	5.17
Ign.	0.50	0.78	0.33	0.69
Sum	100.18%	99.75%	99.76%	100.25%
Sp. gr.	2.570	2.582	2.595	2.606
α	1.5191	1.5219	1.5223	1.5255
β	1.5228	1.5257	1.5260	1.531
γ	1.5249	1.5275	1.5283	1.532

and n_D. New detns. were made, and the sp. gr. and n, calcd. for the K-Na portion when plotted against $Ab\%$, fall in a straight line. The results are shown on preceding page. (I) adularia, St. Gothard; (II) orthoclase, Ceylon; (III) microcline-microperthite, Savelev ravine, Ilmen Mts.; (IV) anorthoclase, Berkum, Rhine. E. F. H. (*C. A.*)

43. Modified method for the detection of tin. H. HELLER. *Z. anal. Chem.*, **57**, 180–2(1922).—Treat 1 cc. of the soln. to be tested with 0.5 cc. of 5% KI soln., and introduce 1 cc. of strong H_2SO_4, by means of a pipet, below the surface of the liquid so as to form a second layer. If Sn is present small characteristic yellow crystals of Sn iodide begin to sep. at the surface between the two layers. The ppt. is sol. in HCl, which should therefore be kept at a min. in the test soln. As and Sb interfere with the test. J. S. C. I. (*C. A.*)

44. Physical chemistry and ceramics. E. W. WASHBURN. *J. Franklin Inst.*, **193**, 749–73(1922).—Sections are devoted to: colloid chemistry and ceramics; heterogeneous equil. at high temps. including the dissociation of kaolin and phase-rule diagrams; properties of silicate solns. at high temps., including soly. of gases, viscosity, density, and elec. cond.; high temp. calorimetry; and standard methods of testing ceramic materials. See *Ceram. Abs.*, **1**, 226(1922). JOSEPH S. HEPBURN (*C. A.*)

45. The titration of zinc. E. MONASCH. *Pharm. Weekblad*, **58**, 1652(1921).—The thiocyanate method of Kolthoff and van Dijk (*C. A.*, **15**, 3047) has been applied to the estn. of Zn in alloys. The potassium mercuric thiocyanate soln. is prepd. by dissolving 23.7 g. of $Hg(CNS)_2$ in a concd. aq. soln. of 14.4 g. of KCNS, and is stable for many months. Compds. of all the common metals interfere, but ferric and Al salts do not affect the reaction. Since M. uses Al in the sepn. of Zn from alloys, the method is suitable for the estns., but Fe salts must first be oxidized by means of peroxide. J. C. S. (*C. A.*)

46. Colloid chemistry. JEROME ALEXANDER. *J. Ind. Eng. Chem.*, **14**, 800–2 (1922).—Colloid chemistry is a distinct zone in the chem. field. Many theoretical and tech. applications are given. No new data or theories are presented. F. E. BROWN (*C. A.*)

47. Chemical reactions on surfaces. IRVING LANGMUIR. *Gen. Elec. Rev.*, **25**, 445–54(1922).—See *C. A.* **16**, 7. C. G. F. (*C. A.*)

48. Volumetric estimation of potassium. MACHELEIDT. *Woch. Brau.*, **39**, 23–4 (1922).—Prep. a standard soln. of NaH tartrate by dissolving 60 g. of tartaric acid and 16 g. of NaOH in water and dil. to 1 l. Add 6 g. of KH tartrate and shake the soln. for several hrs. Filter off 30 cc. and titrate with 0.1 *N* $Ba(OH)_2$ soln. Shake a second 30 cc. for 1 to 2 hrs. with 0.5–0.75 g. of the salt mixt. to be tested, filter the soln. into a tared basin and, without washing the filter, titrate with the $Ba(OH)_2$ soln. Weigh the soln. before and after filtering, and make allowance for the loss. The difference between the two titrations is calcd. to K_2O. J. C. S. (*C. A.*)

49. Chemical constitution of zeolites. G. TSCHERMAK. *Sitzb. Akad. Wiss. Wien*, **126**, 541–606(1917); **127**, 177–289(1918).—Twenty-one new analyses are given of various zeolites. In all cases the ratio Al : Ca(Sr, Ba) + $Na_2(K_2)$ is 2 : 1. Omitting O all zeolites may be represented by the formulas $Si_xAl_2CaH_{2y}$ and $Si_xAl_2Na_2H_{2v}$, where x and z range from 2 to 10, and y and v from 2 to 9. Or again, neglecting H, they all contain a group $Si_2Al_2CaO_8$ or $Si_2Al_2Na_2O_8$. This group is regarded as a nucleus ("Kern") and represented as *Kc* or *Kn*, respectively (also *Kb* and *Ks* for the corresponding Ba and Sr nuclei). The various zeolites are regarded as compds. of one or other of these nuclei with a silicic acid, combined H_2O and water of crystn. The silicic acid and water of hydration are supposed to form a network enclosing the nuclei. Such a structure is regarded as offering an explanation of the variation of the optical characters of the

zeolites with loss or gain of water, the various adsorption phenomena, and the ease with which the bases may be replaced. The following is a summary of the different groups: *A*. Orthosilicates in combination with SiH_4 and H_2O: Natrolite, $SiH_4KnNa_2O_3$ = $Si_3Al_2Na_2H_4O_{12}$. Scolecite, SiH_4KcOH_2 = $Si_3Al_2CaH_6O_{13}$. Mesolite, a double salt of these two in the ratio 1 : 2. Edingtonite, SiH_4KbOH_2, aq. = $Si_3Al_2BaH_5O_{11}$. Gismondine, $H_2OKcO_2H_4$, aq. = $Si_2Al_2CaH_8O_{12}$, also with SiH_4 in place of H_2O. Laumontite, SiH_4KcSiH_2 = $Si_4Al_2CaH_8O_{16}$. Thomsonite, a double salt of the compds. H_2OKnOH_2 aq. and H_2OKcOH_2 in the ratio 1 : 3; also in the latter SiH_4 in place of H_2O. *B*. Disilicates combined with polysilicic acids and H_2O: Analcite, Si_2H_4Kn = $Si_4Al_2Na_2H_4O_{12}$, also with Si_4H_8, Si_4H_4, or H_2O in place of Si_2H_4. Faujasite, $Si_4H_8KcO_2H_4$. 4aq. also with Si_2H_4. Chabazite, $Si_2H_4KcO_2H_4$. 2aq. = $Si_4Al_2CaH_{12}O_{18}$, also with Si_4H_8, Si_2H_2, or SiH_4. Gmelinite with *Kn* in place of *Kc*. Levynite like chabazite with Si_2H_2 and SiH_2. Stilbite, $Si_4H_8KcOH_2$. 2aq. = $Si_6Al_2CaH_{14}O_{23}$, also with Si_6H_{12}, Si_4H_4, or Si_3H_4. Harmotome with *Kb* instead of *Kc*. Phillipsite like stilbite but with Si_2H_4, Si_2H_2, SiH_4, SiH_2. Heulandite, $Si_4H_4KcO_2H_4$. aq. = $Si_6Al_2CaH_{10}O_{21}$, also with Si_6H_6, Si_4H_8, or Si_2H_4. Brewsterite with *Ks* in place of *Kc*. Mordenite like heulandite with Si_3H_8. J. C. S. (*C. A.*)

50. Recent advances in science—geology. G. W. Tyrrell. *Sci. Progress*, **17**, 35(1922).—Sections are devoted to recent work on the chemistry of metamorphic rock and on volcanology. Joseph S. Hepburn (*C. A.*)

51. Recent advances in science—mineralogy. Alexander Scott. *Sci. Progress*, **17**, 41–6(1922).—Review of recent work in mineralogical chemistry. See *Ceram. Abs.*, **1**, 160(1922). Joseph S. Hepburn (*C. A.*)

52. Theory of Brownian movement. G. Jäger. *Sitzb. Akad. Wiss. Wien*, (*2a*), **128**, 1271, 1298(1919).—Stokes's law is held to be inapplicable in the case of Brownian movement. It is shown from consideration of mech. examples that if this law holds, osmotic pressure must be exerted as a continuous force and the consequences of Einstein's equation for Brownian movement and the calcn. of mol. size from diffusion are justified. The distribution of energy for particles of any no. of mols. may be obtained from Maxwell's law directly by gradual building up of groups from mols. The velocity of particles relative to the liquid medium, including their Brownian movement, is only to a small degree dependent on their mass. J. C. S. (*C. A.*)

53. Some fundamental conceptions of colloidal chemistry. Electrical charge on particles and the new conception of "micelle." Richard Zsigmondy. *Z. physik. Chem.*, **101**, 292–322(1922).—A discussion. H. Jermain Creighton (*C. A.*)

54. Determination of calorific value of coal. F. S. Sinnatt and M. B. Craven. Lancs. Cheshire Coal Research Assoc., *Bull.* **10**, 23 pp.(1921).—Formulas for the calcn. of calorific value from the proximate analysis of coal (cf. Goutal, *Compt. rend.*, **135**, 477–9(1902)) are accurate when dealing with samples from the same seam except when the coal contains Ca or substituted Ca carbonates; the value for one of the samples should be detd. in a bomb calorimeter, the manipulation of which is described in detail. J. S. C. I. (*C. A.*)

Refractories and Furnaces

55. Quartz and flint in America. R. Rieke. *Trans. Ger. Ceram. Soc.*, **2**, 168 (1921).—Comparisons of quartz and flint as used in the American and German ceramic industries were made by measuring the rapidity of change to cristobalite when heated to 1430°C in a porcelain kiln by noting the lowering of the sp. gr. (cristobalite = 2.32). The results tabulated follow:

		Sp. gr. before burning	Sp. gr. after burning
Amer. Mat.	Silica Sand	2.67	2.49
	Quartz Rock	2.66	2.49
	Flint Pebbles	2.57	2.28
	Chalcedony	2.66	2.32
Germ. Mat.	Norwegian Quartz Rock	2.65	2.37
	Hohenbocka Silica Sand	2.65	2.59
	Flint (German)	2.63	2.23

These results indicate that care should be used in applying the results of American research to German raw materials. FRED A. WHITAKER

56. Grinding broken saggers. ANON. *Brick Pot. Trade Jour.*, **30**, 208-9(1922).—Good grog should have angular grains and be free from dust. An edge runner mill with a solid pan should be avoided as this has a tendency to produce round grains and considerable dust. A cylinder grinder with pebbles or balls should also be avoided as the rubbing action in this grinder produces an excess of dust. The various pendulum mills are also open to the same objection. Jaw crushers are excellent preliminary crushers but do not work economically when required to reduce all the pieces to less than $^1/_2$" in diam. Crushing rolls are excellent for reducing material from pieces not more than 1" in diam. to the required fineness. It is generally desirable to use two sets of rolls, one to reduce to $^1/_8$" and the other to finish the grinding. Specially designed edge-runner mills with revolving perforated pans can be used. They are more costly to maintain than crushing rolls. Ball mills with sepg. devices which remove the material as soon as it is crushed may also be employed. They should be fed with material not more than $1^1/_2$" in diam. Stamping mills are not efficient and are too noisy. Disintegrators consisting of a series of hammer bars mounted radially on a horizontal shaft are the best for crushing grog. They require to be fed with pieces not more than 2" in diam. A sieve is desirable to remove the coarse and fine grog with any grinder in order to produce a grog of max. quality. H. G. SCHURECHT

57. The volatilization of silica in the manufacture of refractories in electric furnaces. RI. *Deut. Töp. Zieg. Ztg.*, **53**, 221–2(1922).—Amorphous SiO_2 containing 99.15% hydrated silica and which deformed at cone 35 was placed in a crucible and heated in an elec. fur. in an oxidizing atmos. at cone 39. No appreciable volatilization was noticed. When this same SiO_2 was placed in coke blocks and heated in the same fur. the SiO_2 volatilized rapidly and was deposited in the cooler portions of the kiln. Similar expts. were made on a number of substances and the ingredients which volatilized detd. by chem. analysis (see Table I). I is a fusible brick clay; II a feldspar, III a second grade fire clay, IV a good fire clay, and V a highly refractory kaolin. VI, VII, and VIII are mixts. of kaolin with MgO, CaO and K_2O. In all cases the SiO_2 volatilized more than the Al_2O_3. The alkalies volatilized more than the SiO_2. The product which condensed on the cooler portions of the kiln was composed principally of K_2O and SiO_2 with small amts. of Al_2O_3 and CaO. The volatilization of SiO_2 in a reducing atmos. is explained by reduction of the SiO_2 which would liberate the extremely volatile Si. H. G. SCHURECHT

58. Basic slag manufacture, Great Britain. ANON. *Chem. Age*, **7**, 315(1922).—According to an interim rept. just made to the Minister of Agric. there is some likelihood of their being a diminution in the supplies of basic slag next season. The rept. is made by a permanent Comm. appointed by the Minister to consider the development and improvement of the manuf. of basic slag and the extension of its use, and it contains a record of their expts. and results during last year. The demand for ground basic slag by the farmers of the United Kingdom has doubled since 1912. Production

TABLE I

	I		II		III		IV		V		VI		VII		VIII	
	Burned	Melted	Burned	Melted	Burned	Melted	Burned	Melted	Burned	Melted	Burned	Melted	Burned	Melted	Burned	Melted
SiO_2	64.91	64.01	65.48	64.97	72.82	68.71	59.59	53.23	55.05	50.37	51.76	43.85	51.40	50.67	51.83	48.49
Al_2O_3	11.90	14.81	19.00	20.86	21.48	26.40	33.90	41.65	41.56	46.94	39.07	43.71	38.80	41.04	39.22	46.21
Fe_2O_3	17.39	16.39	0.28	0.21	2.00	1.78	2.76	1.90	1.25	1.06	1.17	0.68	1.17	1.20	1.18	1.07
Mn_2O_3	2.09	2.45	...	...	...	...	...	...	...	...	...	...	...	...	...	...
CaO	1.09	0.99	0.50	0.25	0.68	.4	0.38	tr.	0.50	0.23	0.47	tr.	7.11	6.79	0.48	0.11
MgO	1.40	1.11	0.39	0.38	1.11	0.98	0.96	0.87	0.29	0.34	6.52	11.70	0.25	0.20	0.24	0.34
K_2O	0.92	0.13	14.22	13.06	2.27	1.96	2.61	1.95	1.06	0.75	1.28	0.35	1.24	0.32	7.48	3.61
Na_2O	...	...	0.36	0.21	...	...	...	...	...	...	...	...	...	...	...	...
Cone	3	2–3	14	16	28	27	32	35	35	37–38	15	14	27–28	26	28	35–36

has not likewise increased and in 1920 and 1921 was considerably less than the demands. There has been a reduction in quality owing to the supersession of the Bessemer process by the open-hearth process. The slag now obtainable contains only half the percentages of phosphate of pre-war days, and much of it shows reduced soly. The demand has been met to some extent by importation but it is likely that the quality of basic slag manufd. on the continent may decrease, as it has in the United Kingdom, as a result of a similar change in process. With regard to the possibilities of increased or improved production, there has been little change in blast-furnace or steel-furnace procedure as for the purpose of improving either the output or the quality of slag. From the steel makers' point of view, basic slag is relatively unimportant. The practical result is that the compn. of basic slag is detd. by the conditions under which the steel-maker is working, and the total amt. producible is regulated by the demand for steel. The use of such substitutes as ground mineral phosphates would afford a ready means of solving the problem. The fertilizing value of these phosphates is being investigated. It is proved that high sol. open-hearth basic slags have the same agricultural value per unit of phosphoric acid as the old Bessemer slags and that low sol. slags and mineral phosphates have a smaller value. The Comm. express the hope that they may ultimately be able to map out the country into regions where the high sol. slag can effectively be replaced by low sol. slags and mineral phosphates. They also hope to ascertain whether very low grade slag could be used with an admixture of mineral phosphates. The rept. concludes with the suggestion that the official soly. test needs revision.

O. P. R. O.

59. One piece furnace lining. I. S. Pieters. *Iron & Steel of Canada*, **5**, 156 (1922).—Discusses the merits of the one-piece monolithic lining for refractory fur. compared with the brick lining. In the former there are no joints to cause weakness, to serve as channels for cold air to enter the fur.; no bricks to loosen and fall out; no cement to fuse and disappear and no unequal expansion and contraction. There is no chem. action between different substances. The lining material is chosen for its ability to withstand heat and fur. conditions. The life of the fur. has been increased up to 500%, reducing the cost of upkeep proportionally. It has enabled boilers to operate for more than a year and sometimes for 2 yrs. without a shut down for fur. repairs where with brick, a new lining was required several times a year. It has increased combustion efficiency thus lowering the cost of fuel. Boiler evapn. has been increased economically far beyond the range formerly possible with economy.

O. P. R. O.

60. Graphite in Canada. V. L. Eardley-Wilmot. *Can. Inst. Min. & Met. Trans.*, **26**, 124(1922).—For commercial purposes, it is convenient to distinguish three varieties of graphite: crystalline, flake and amorphous. Flake graphite occurs disseminated through the containing rock, whereas the crystalline forms true veins of more or less compact graphite. Amorphous graphite approaches coal in its physical characters, and is often found in contact with coal seams, shales and slates. Graphite mining in Canada is confined to the provinces of Ontario and Quebec. E.-W. describes finishing and polishing, and flotation systems. Samples of Canadian graphite were submitted to all known crucible makers, but the general verdict was that although from the chemical standpoint Canadian graphites are as good as, or even better than the Ceylon graphite, they are inferior in physical characters. Re-floating in the Callow cells, followed by careful tabling and screening, has produced an 80-mesh, 87 to 90% concentrate, distinctly more angular, and denser than ordinary "finished" products. These samples have been submitted to crucible makers who reported this "natural" flake as good in every way as the best Ceylon graphite, and that it could be used in the crucible industry. Graphite mills and operations are described. O. P. R. O.

61. Fire brick. ANON. *Industrial Canada*, **23**, 94(1922).—A hitherto unknown industry in Canada is to be established by the Canadian By-products Co. Ltd., at Hamilton. They purpose mfg. fire brick, fireproof building brick and tile, under 4 basic patents. The plant will have a capacity of 20,000 fire brick and miscellaneous refractories and will be able to supply the demand hitherto supplied by importation from U. S. and Scotland. O. P. R. O.

62. Notes on jointing materials for refractories. L. BRADSHAW AND W. EMERY. *Trans. Ceram. Soc.* (Eng.), **21**, 107–16(1922).—In general, the jointing material used for laying fire clay bricks consists of a mixt. of ground raw clay and grog, with or without sand, while for silica bricks, crushed silica with a small propn. of fire clay is employed. It is well known that the softening temp. of silica fire clay mixt. is lower than that of either constituent. The authors found that the curve for fusion points of mixt. of finely crushed silica brick and fire brick corresponded roughly to Seger's curve for pure silica. When tested under load of 35 lbs. per sq. in., the values fall into the same order as those of the ordinary refractoriness, but the curve is steeper on the silica side and flatter on the fire clay side, *i. e.*, the differences between the softening temp. with and without load are less in the case of siliceous mixt. than for mixt. rich in fire clay. The softening point under load of 100% fire clay brick grog was cone 20. The introduction of 40% silica brick lowered the softening point only to cone 19. When coarser grained mixts. are substituted for those used in the foregoing experiments, the effect upon the softening point is less marked. In the prepn. of mortars for fire clay bricks, the addition of grog to fire clay is a general practice. The grading of sizes and proportioning of the materials used are of prime importance. The effect of mixing carefully graded materials in various propn. was studied. The coarsest grade used all passed 20-mesh. When the material has a high contraction, cracks develop during the air-drying, while in other cases they appear only after firing. These cracks are invariably transverse, *i. e.*, across the joint, owing to the shrinkage along its length. Longitudinal cracks generally do not appear. A briquette of fine clay forms a hard compact mass free from cracks, which offers very high resistance to crushing and slag penetration. The same clay, after firing between bricks, exhibits large fissures into which slag can penetrate freely. The sharp increase in the contraction of the clay with diminishing grain size of clay was clearly shown, as also the corresponding increase in mechanical strength and the resistance to slag penetration. The addition of grog largely reduces the contraction and allows a greater penetration of slag. Of the mixt. examd., those composed of mixed grades of clay and grog appear to give the best results. These mixts. are mechanically strong, have a sufficiently small contraction, and set between bricks to a hard compact mass, which is free from cracks and is not easily attacked by molten slags. The addition of sand diminishes the fire-shrinkage, but renders the mixt. friable. It is evident that the prepn. of a suitable mortar is mainly a question of balancing the opposing qualities of its constituents. H. F. S.

63. The influence of oxidizing and reducing atmospheres on refractory materials. L. BRADSHAW AND W. EMERY. *Trans. Ceram. Soc.* (Eng.), **21**, 116–52(1922).—Seger cones heated in a current of coal gas remained erect at temps. far above their normal softening points. These cones were found to consist merely of a hollow shell with a quantity of slag discharged at the base, or of a semi-vitrified mass covered with an infusible skin. The outer shell is extremely refractory. The effects are observed not only in the lower cones containing borax frit, but also in the higher ranges of cones which are free from borax and other volatile matter and also free from iron. It appears to be due to the formation of a thin film of hard carbon in intimate contact with the surface of the cone. It has been found possible to drain off the slag from the interior, leaving the outer shell intact. The cone is mounted over a hole of suitable size bored

through a thin refractory plate which forms the lid of a hollow cylinder of the same material. On heating in a current of coal gas to a temp. considerably above the normal softening point of the cone, the viscous material is discharged into the receptacle below, while the refractory shell remains standing and appears from the outside unaltered. The surface deposition of hard carbon is also observed with test pieces of fire clay brick heated in an atmosphere of coal gas. The refractoriness of the shell is so very much higher than that of the untreated material that if the fact can be applied practically, it should be possible to make a super-refractory from the purer clays. The imparted refractoriness might not endure under working conditions. H. F. S.

64. Graphite in Siberia. ANON. *Raw Materials Rev.* (London), **1**, 155(1922).—As the result of various hydrographical and geological expeditions which recently investigated parts of Siberia, deposits of graphite have been found on the River Kureiki, a tributary of the Yenisei. These are estd. to contain at least 200,000,000 roods, or enough to satisfy the requirements of the world for several decades. Deposits of graphite have also been noted along the River Podkamennoi Tunguske, together with extensive measures of coal and cupreous nickel ores. O. P. R. O.

65. Illinois fire clays. C. W. PARMELEE AND C. R. SCHROYER. Illinois State Geol. Surv., Ext. from *Bull.* **38**, 149 pp.(1921).—A proposed new classification of clays according to use includes: I, clays burning white or cream colored, not calcareous; IA, open burning, porous at cone 15; IB, dense burning, non-porous or nearly so at cone 10–15; IC, dense burning, non-porous or nearly so at cone 5–10; II, buff burning clays; IIA, refractory; IIB, non-refractory; III, clays burning red, brown, or other dark color; IIIA, open burning, not attaining low porosity until near or at the fusing point; IIIB, dense burning with a more or less extended vitrification range; IV, clays burning dirty white, cream or yellowish white. Further subdivisions are given and the typical uses for the different classes are given. The various types of clays are described and methods of conducting the physical tests are detailed. The geology of Illinois clays is reviewed and many deposits are described. Judged by their physical properties the samples are classified as follows: refractory clays showing a porosity of 5% or less at cone 9 or under, 20; refractory clays showing porosity of over 5% below cone 9, 30; stoneware clays, 48; architectural terra cotta clays, 53; sewer pipe clays, 9; face brick clays, 45; common brick, tile, etc., clays, 10; sanitary ware clays, 48. The same clay may appear in more than one of the above classes. C. H. KERR (*C. A.*)

PATENTS

66. Insulating cement or mortar. ARTHUR S. ELSENBAST and WALTER J. JORDAN. U. S. 1,421,192, June 27, 1922. An insulating cement comprising powdered diatomaceous earth, clay, and starch. C. M. S., JR.

67. Composition for producing coatings on refractory articles. WILLIAM ROY MOTT. 1,425,603, Aug. 15, 1922. As a new article of manufacture, a refractory article provided with a coating comprising an oxy-compd. of boron, associated with iron and chromium. C. M. S., JR.

68. Refractory silica brick and process of manufacture. ORAZIO REBUFFAT. Italy. 1,420,284, June 20, 1922. The process of rapid conversion of quartz into its allotropic varieties of lower specific gravity by incorporating therein small quantities of the radicals of acids nonvolatile at high temperature and calcining the same and recovering the allotropic varieties of the quartz of lower specific gravity than quartz. Cf. *Jour. Amer. Ceram. Soc.*, **4**, 945(1922). C. M. S., JR.

BOOK

69. SEXTON, A. HUMBOLDT: **Fuels and Refractory Materials.** Revized and enlarged edition. Edited by W. B. Davidson. New York: Van Nostrand Co. 382 pp. $4. Reviewed in *Am. Gas J.*, **116**, 561(1922). (*C. A.*)

Abrasives

70. Greek emery exports. ANON. *Oil and Colour Trade Jour.*, **62**, 615(1922).—The export of emery stone is yearly increasing in importance. O. P. R. O.

71. Bauxite in India. L. L. FERMOR. *Geol. Surv. of India, Records*, **53**, 250(1922).—Extensive deposits of bauxite have been found in India, which compare in quantity very favorably with the Irish, French and American bauxites. In order of importance these deposits are located in the Provinces of Bombay, Bihar and Orissa. The analyses given indicate these bauxites are of great economic value. O. P. R. O.

72. Corundum in the Northern and Eastern Transvaal. A. L. HALL. Union of S. Africa, *Geol. Surv., Memoir*, **15**, 1920.—In a region of 200 sq. mi., corundum occurs in several forms: (1) crystal corundum, found in loose crystals in shallow alluvial deposits, (2) boulder corundum in loose blocks embedded in a matrix, and more resistant to weathering, (3) reef corundum, in vertical veins intrusive in the basic formation, and commonly a few feet or yards thick. In the Plateau region the corundiferous reefs are felspathic while in the low country reefs are characterized by margarite instead of feldspar. The crystal, boulder and reef corundums have been exploited commercially, with very favorable results. Large quantities of corundum are available and for commercial plumasite or marundite ore bodies, a corundum content of from 30 to 60% is a conservative estimate. In the absence of nepheline and allied alkaline rocks, the Transvaal fields are not comparable to the Ontario corundum-bearing localities, but they show many points of resemblance to those of the eastern U. S., and to certain deposits in Natal. From the economic point of view, the S. African corundum fields are the most extensive and richest in the world. The deposits contain the makings of a valuable industry, notwithstanding the severe competition of artificial abrasives. Among the conditions to be arrived at are (1) more uniform methods of grading, (2) maintaining a definite and high standard of purity, and (3) closer contact between producer and consumer. The export of graded corundum in grain form, instead of the present shipments of crystal corundum in different conditions of purity (freedom from gangue) would do much toward establishing a future corundum industry on a permanent economic footing, leading up to the manuf. of abrasive tools. Illus. and bibliography on corundum. O. P. R. O.

73. The east Adriatic bauxite. F. KERNER-MARILAUN. *Montan. Rundschau*, **14**, 73–8(1922).—A description of the geological occurrence and characteristics of several types of bauxite. R. S. DEAN (*C. A.*)

Stoneware, Whiteware and Porcelain

74. Porcelain fittings for wireless. ANON. *Times Trade Supp.* (London), **101**, 218(1922).—The development of wireless broadcasting and the popular demand for wireless receiving sets have called for elec. porcelain fittings of new and particularly exacting design. Practically every piece of elec. app. necessitates some porcelain fitting, so that all these provide some new business for elec. porcelain manuf. High-tension generating and distributing installations necessitate porcelain of greater durability and higher insulating property than formerly, and wireless plants require new types of insulators. English manufacturers are able to meet the demand effectually, in face of keen German competition. O. P. R. O.

75. The manufacture of pottery. ANON. *Brick. Pot. Trades Jour.*, **30**, 207–8 (1922).—Wet mixing is preferred to dry mixing. The ware is biscuited at 1100–1300°C in 45–70 hrs. and cooled in 48 hrs. Glost burn is at 900–1100°C and decoration is done at 600–850°C. H. G. SCHURECHT

76. The heating of a porcelain oven by means of fuel oil. J. Chauvisé. *Bull. officiel direction recherches sci. ind. inventions*, No. **32**, 326–39(June, 1922).—Satisfactory results have been obtained at the Manufacture Nationale de Sévres. A. P.-C. (*C. A.*)

77. Translucency of porcelain. W. Steger. *Trans. Ger. Ceram. Soc.* **2**, 9(1921).—By observing the increasing translucency of porcelain during burning a valuable check on the maturing process can be obtained. The translucency increases as the smaller sillimanite crystals are gradually merged into larger ones. The following methods of comparing translucency are described: (1) Hand method of judging the sharpness of the contour of the hand when held between the porcelain and the light. (2) Screen method (*Trans. Amer. Cer. Soc.*, **13**, 102(1911)). (3) Wedge method (*ibid.*, **17**, 150, (1915)). (4) Martens photometer (*ibid.*, **17**, 150(1915)). (5) Bouguer photometer. (6) Weber photometer. Fred A. Whitaker

78. The solubility of coloring metal oxides in china glazes. R. Riche and Ing. W. Poetsch. *Trans. Ger. Ceram. Soc.*, **2**, 77(1921).—In melting a glaze containing a metal oxide four possiblities present themselves: (1) Mechanical suspension of the oxide as such in the glaze instead of solution. (2) Solution under heat but crystn. during cooling. (3) Complete or partial crystn. if glaze is supersaturated. (4) Oxides react with the other components of the glaze to form silicates, borates, etc. The effect of various metal oxides in combination with 4 glazes of the following types was studied: (1) A soft lead, low alkali, boric acid glaze for cone 09. (2) A leadless boric acid glaze also for cone 09. (3) A harder glaze for cone 2*a* with only traces of boric acid. (4) A commercial leadless glaze for cone 2*a* containing no boric acid. It was established that the chem. compn. of the glaze rather than the m. p. detd. its capacity for dissolving oxides. Glazes low in Al_2O_3 showed the highest soly. The above combination of glazes and oxides was later ground fine and reburnt as glazes on a china body and in no case was there any sign of crazing. F. Kraze arranges the oxides as anti-crazing agents in the following order: Co, Cu, Cr, Mn, Fe, Zn, Ba, Ca, Mg, K, Na. In testing the oxides for properties as underglaze colors it was found that Cr_2O_3 showed the least soly. in all 4 glazes and gave the sharpest lines. Fred A. Whitaker

79. Translucency of porcelain. W. Steger. *Trans. Ger. Ceram. Soc.*, **2**, 63(1921).—Tests with simple porcelain bodies composed of kaolin, quartz and feldspar showed: (1) Translucency is inversely proportional to thickness. (2) Curves plotted to show the relationship between thickness and translucency of the different bodies form straight lines and run exactly parallel where ratio of quartz to feldspar is the same and the translucency increases as the clay substance content decreases. (3) By extending these to their intersection with the ordinate (thickness = 0) values were established and plotted against the clay substance content of these test bodies and again a straight line resulted. Supplementary tests with a more complicated porcelain containing ball clay gave a curve running almost parallel with those obtained with the test batches which led to the supposition that the ratio of quartz: feldspar was approximately the same as in these. Following this out as in (3) a theoretical clay substance content of 57% was indicated and later confirmed by rational analysis. This indicates the possibility of detg. the approx. rational analysis of a porcelain by measuring the translucency and comparing it with standard porcelains. Fred A. Whitaker

80. Malaya's new pottery industry. Anon. *Jour. Roy. Soc. Arts*, **70**, 676(1921).—This plant introduces an entirely new industry in the country. It is equipped to handle all the processes from refining the crude clay to the decoration of the completed piece and is situated about 16 mi. from Ipoh. Casting and jolleying are the processes used, permitting a comparatively large output with labor that is not yet thoroughly trained. Teapots, jugs, ewers and basins are already being turned out by Malay girls who had never seen a pottery until a few weeks ago. All the required materials are found within

3 mi. of the works and besides supplying its own clay the company ships china clay to cotton mills in Bombay and paper mills in Calcutta. The barrels for packing the product are also made at the works. O. P. R. O.

81. Fine grinding in the potteries. Editorial. *The Engineer* (London), **134,** 222(1922).—Alsing introduced the tube mill in 1870 for the grinding of calcined flints in the Staffordshire potteries. Inquiry shows us that the tube mill, which has come so much into favor in other industries, among which metallurgy and cement making may be mentioned, has really made but little progress in ousting its only rival, the wet chert mill, from local favor. The chief advantage lies in first cost. It is now not far short of 150 years since Brindley brought out the wet grinding mill or "pan," at the behest of Wedgwood, who had just initiated the use of flint in pottery, and decided upon the use of chert or hornstone as the abrasive medium. There is practically no difference in the design of the pans to be seen in operation today from those in use a century ago or at the time of their introduction. Only a few potters do their own grinding, which is a separate business carried out by milling firms. They buy the siliceous materials in bulk and sell them in the form of slop to the pottery manufacturers. The chert grinding is in the form of a mortar mill, 14 ft. diameter and 3 ft. high, the bottom being lined with chert blocks about 1 ft. thick. Over this bed 4 large blocks of chert called runners, fixed to 4 arms at right angles, revolve at a speed of 15 r. p. m. A common wt. for these runners is 16 cwt., though much heavier stones have been used. The pulp from these mills has to pass a 140-silk or wire mesh. The tube-mill has the advantage in first cost but it is not the mill proper which represents expense in the chert pan but the heavy gearing, a considerable amt. of power being required to start and run it. Almost as much is required for a tube mill of similar capacity at the start, but afterward the power required is considerably less than with the chert mill. Those who have installed the tube mill say that it effects an economy, but this does not seem to amt. to a great deal if the saving does not exceed one shilling per T. of material ground, as it is claimed. A point in favor of the tube mill has been brought about by the present high price of chert. The tube mill occupies less space than the older grinder and need not necessarily be put on the ground floor. Against the tube mill, is the heavy hand of certain potters, who specify in contract that slop be the product of the chert pan. As long as this preference exists there is no likelihood of the chert pan being scrapped in favor of its younger rival. For some time, both systems of grinding will be carried on in close propinquity. For the first time in its long existence an important grinding mill in the potteries has just had a tube mill erected close to its battery of chert mills, and the various verbal reports as to the relative economy of the systems will be added to by another based on carefully recorded data. The necessary facilities exist for making trials of the relative systems which may be taken as comparative and free from bias. With regard to the flints used in the tube mills, the Staffordshire millers are in a good position, as those best adapted for the purpose are selected from the heap awaiting calcination and grinding. An important attribute of chert as a grinding medium is that its gradual wearing down does not add any deleterious foreign matter to the flint, as would be the case if certain other stones were used. O. P. R. O.

82. Pottery. Anon. *Chem. Eng. & Min. Rev.*, **14,** 369(1922).—A unique display of W. Australia pottery was held in Perth recently. The exhibition comprised a most interesting collection of W. Australian pottery clays and a wide range of articles, from bricks to semi-porcelain ware, from glass bottles to Hume concrete pipes. O. P. R. O.

83. Spit-out of glazes on passing through an enamel kiln. Jno. Miles. *Trans. Ceram. Soc.* (Eng.), **21,** 208–26(1922).—Spit-out faults are really due to small bubbles of gas, which, coming chiefly from the pores of the body, pass through the glaze when the latter becomes viscous while in the enamel kiln, leaving the surface of the glaze

more or less rough. The gas is generally superheated steam generated from moisture in the body. If the glaze remains soft enough in the enamel fire for a sufficient length of time, these gases will make their exit and the glaze surface will become smooth. In drying ware before putting it into the enamel kiln, the point where the glaze is broken must be the topmost point of the piece. To reduce spit-out losses, it is necessary (1) to avoid flash firing in biscuit; (2) to fire the glaze well up in glost; (3) to avoid damp atmosphere and water in the glost warehouses, and (4) to allow no rushing in firing enamel, especially between 650 and 800°C. In the discussion it was claimed that other factors, in addition to steam, such as carbon, in the body might cause spit-out. H. F. S.

84. Closed circuit grinding. J. C. FARRANT. *Trans. Ceram. Soc.* (Eng.), **21,** 125–52.—"Closed circuit" signifies that the material which is insufficiently ground is sepd. out by a classifier and returned to the mill for regrinding. The system of closed circuit grinding applies both to wet and dry reduction. This paper deals particularly with the use of Hardinge mills for the grinding. Tests have shown that in closed circuit wet grinding: (*a*) if the balls or pebbles are large and speed of mill is high, crowding will appear at the finer sizes in oversize; (*b*) if the balls are small or the speed is low, crowding will appear at the coarser sizes in the oversize; (*c*) the product from a mill with large balls and high speed will be more uniform than the product from a mill with low speed and small balls. The author gives examples of the use of Hardinge mills in grinding iron ore, barytes and flint, then concludes: "In the foregoing examples, the finished products ground at the various plants were detd. more by the size of the largest particles than the amount of "slime" or "flour" that was produced. In grinding to the potters' requirements this method of detg. the critical grinding point will not hold good because it is necessary to produce a more or less fixed propn. of "slime" or exceedingly fine material, in addition to grinding through a given lawn. In order to meet the grinding requirements of the pottery trade, it will be necessary to feed the grinding mill at such a rate that a max. amt. of the desired product is obtained per h. p. H. F. S.

85. Factory preparation and burning of whiteware bodies. ARTHUR S. WATTS. *N. J. Ceramist,* **1** [2], 91–6(1921).—A discussion of the prepn. and burning of whiteware bodies covering briefly the following topics: (1) raw materials, (2) cleaning dirty ball clay, (3) mixing the body, (4) prepn. of stain. The author recommends the following as the correct propn.: to 750 oz. of pure water add 15 oz. pure cobalt sulfate and stir until dissolved. Then add 7.5 oz. carbonate of soda. The proper propn. of stain to body are: for a body contg. 10% ball clay, add 75 oz. of stain soln. to each 1500 lbs. of body. For bodies with higher ball clay content increase the stain addn. in the same ratio up to 15% ball clay. For stain in glazes add 10 oz. of stain to each 100 lbs. of dry glaze. Glazes high in lead require more stain. (*a*) *Sieves.*—Revolving sieves are less costly and do not clog so easily. (*b*) *Filter press pressure.*—Max. pressure should be 80 lbs. for a body free from ball clay. Add 2 lbs. for every 1% of ball clay present. When the press stops running water, increase the pressure 10 lbs. for a few min. (*c*) *Aging and its effect.*—The temp. of clay cellars should be kept above 80°F and the relative humidity should be 90°. Aging is bad for elec. porcelain since it gives rise to gas blebs in the body. (*d*) *Plasticity.*—Plastic clays are either "greasy" or "sticky." Eng. and Amer. clays differ in this respect. "Greasy" plasticity is preferable. (*e*) *Pug mills.*—A slow rate of pugging produces an open body. A faster rate produces a granular, weak body. Too much speed causes the clay to heat. (*f*) *Setting the kiln.*—The first and second rings should be set 1″ apart, except midway between the cuts, and the inside rings all set a like distance. Leave a 1-in. opening between all rings. Not more than 6″ should be left between the top of the bungs and the crown at any point.

In downdraft kilns, the center of the kiln may be set 12 to 15″ below the crown, and the burn improved if an opening is provided from top to bottom in center. (*g*) *Kiln firing.*—For burning hard-fire porcelain, free from ball clay, with the body biscuited, the glost fire may progress as fast as the coal will burn, maintaining a condition bordering on reduction from the time the kiln is hot enough to develop such a condition, *i. e.*, from about the tenth hour. For best results, the fuel beds must never burn low enough to leak any air, as a highly oxidizing condition is as dangerous as a condition of extreme reduction. The temp. is dropped fast after finish to an orange-red, then closed and cooled slowly. By this plan it is possible to burn a 16-ft. kiln to cone 15 in 20 hrs. (*h*) *For sanitary ware and elec. porcelain* the author gives the method of firing in considerable detail. C. W. PARMELEE

86. Zircon spark plug porcelain. G. A. PRITCHARD. *N. J. Ceramist*, **1** [2], 145–6(1921).—Porcelain made by the use of zirconium silicate has three important properties: high dielec. strength, great mechanical strength and great resistance to temp. changes. Zircon spark plugs have been heated to a temp. of 2400°F, and plunged into ice cold water without development of cracks. C. W. PARMELEE

87. The use of stain in bodies. C. W. PARMELEE. *N. J. Ceramist*, **1** [2], 117–25 (1921).—The principles involved in the correction of color of whiteware bodies by the choice of materials; use of reducing fire; use of stains. The compn. of stains, insoluble stains; use of cobalt salts, particularly the sulfate; general directions regarding the proper amt. of reagent necessary for pptn. of sol. cobalt salts in the body. C. W. P.

88. Sagger bodies and tests of same. W. STEGER. *Trans. Ger. Ceram. Soc.*, **2**, 142(1921).—Unusual ingredients mentioned are magnesite, corundum, zirconium oxide, carborundum. F. A. WHITAKER

89. Modern developments in German fine ceramic products, particularly in the manufacture of porcelain and faience. W. FUNK. *Z. angew. Chem.*, **35**, 81–3(1922).—A review and history with an outline of important problems to be solved, including the development of better fuels, better burning methods, the finding and using of new sources of feldspathic materials, the adaptation of German kaolins, the development of lower temp. hard porcelains which can be more economically produced, etc. C. H. K. (*C. A.*)

90. Dielectric strength of solid insulating materials. W. S. FLIGHT. *Elec. Rev.* (London), **90**, 39–41, 76–9(1922); *Science Abstracts*, **25B**, 157–8.—The author deals with the factors affecting the elec. strength of solid materials such as varnished cloth, micarta, mica paper, and flexible micanite. The following are touched upon: the test equipment; initial temp. of the insulation; thickness of insulation; shape of the insulating material; duration of application of voltage; thermal capacity of the electrodes; size and shape of electrodes; moisture content; tests carried out in air or in oil. Curves are given showing how the elec. strength varies with the no. of layers and also with the thickness of a fibrous material. The distribution across 3 layers of varnished cloth is plotted in the form of curves. The effect of time of application is illustrated by test curves on a micarta cylinder, oil-treated fuller-board, and varnished cloth. Test curves are also given showing the behavior of mica cambric under dry and humidified conditions. The author recommends that the temp. of the test sample and the electrodes should be approx. 90°. With reference to the length of time of application of the pressure, all figures should be based on the max. voltage that the material will withstand for one minute. This is detd. by first running up at the rate of 1 kilovolt per second and then attempting to apply 75% of the max. voltage for one minute. From the result of this second test the max. voltage the material will withstand for one minute can be ascertained. The area of the electrode should be 4 sq. in. Before testing, the test samples should be artificially dried and suspended for 24 hours in a humidifier at 25°. E. H. (*C. A.*)

PATENTS

91. Treatment of china clay or like clays. ANON. Pat. 183,535. *Chem. Age* (London), **7,** 320(1922).—A suspension of china clay in water is allowed to settle by gravity or is separated by mechanical means until it becomes a thick paste having a water content of about 50%. The material is then dried in an evapg. plant such as that described in Specification No. 149,055 (see *Chem. Age,* **3,** 292). In the drying plant the material is fed in a parallel series of thin films on to drying surfaces arranged in a number of chambers connected to operate in multiple effect. In this app. the drying surfaces are heated by vapor evolved from material being dried, the vapor being compressed to raise its temp. The process of drying the wet clay in blocks in a kiln by combustion gases is thus avoided, and the dry clay is obtained by a rapid and continuous method. O. P. R. O.

92. Preparing clay for making ceramic ware. G. W. LAPP. U. S. 1,424,924, Aug. 8. A slip is filter-pressed and the pressed cakes are subjected to pressure *in vacuo* to remove occluded air and gases. (*C. A.*)

93. Machine for working up ceramic masses into tiles, disks, and similar bodies. ERICH GERBEL. Germany. 1,420,093, June 20, 1922. In a machine for making disk-shaped objects and the like from ceramic masses, a vertically adjustable support for a mass block; means for truing the mass; means for successively cutting disks from the mass, and means for receiving and supporting the cut disks, the adjustable support and the disk cutting means being arranged for relative movement toward and from each other. C. M. S., JR.

Art and Design

94. Standardization of colors. H. TRILLICH. *Farben-Ztg.,* **27,** 672–4(1921).—See *Ceram. Abs.,* **1,** 256(1922). E. J. C. (*C. A.*)

95. Color standards. HANS HELLER. *Farben-Ztg.,* **27,** 2495–7(1922).—H. contests some of the suggestions of Trillich (see abstract above) and of Ostwald on the standard designation of colors. **Reply.** HEINRICH TRILLICH. *Ibid.,* 2556–7. (*C. A.*)

Heavy Clay Products

96. Elimination of waste-paving bricks. U. S. BUR. STANDARDS (Simplified Practice Recommendation No. 1), **1922.**—In accordance with the unanimous action of the joint conference of representatives of manufacturers, distributors, and users, the U. S. Department of Commerce, through the Bureau of Standards, recommends that recognized types and sizes of paving brick be reduced to the following list:

STANDARD SIZES AND VARIETIES

Standard Sizes

Width, inches	Depth, inches	Length, inches	Width, inches	Depth, inches	Length, inches
3	4	8½	3½	3½	8½
3½	4	8½	3½	3	8½

Standard Varieties

Plain wire-cut brick (vertical fiber lugless)				Repressed lug brick	
3	4	8½	3½	3½	8½
3½	4	8½	3½	4	8½

Vertical fiber lug brick			Wire-cut lug brick (Dunn)		
4	3	8½	3½	3	8½
4	3½	8½	3½	3½	8½
...	...	...	3½	4	8½
Hillside lug brick (Dunn)			**Hillside lug brick (repressed)**		
3½	4	8½	3½	4	8½

This recommendation describes the need for eliminating economic waste caused by the excessive variety in types and sizes of paving bricks, and shows the procedure used in reducing existing varieties from 66 to 7. The industry initiated the action through its trade association, and the Govt., through the Department of Commerce, endorses and publishes as its own those simplifications recommended by joint conferences of producers, distributors and users of the commodity. H. F. S.

97. Brick industry in New Brunswick. ANON. *Industrial Canada*, **23**, 72(1922).—An impetus has been given to the industry in N. Brunswick by the opening of a new plant at St. John, by the Stephen Brick Co. Modern equipment of the most efficient type has been installed. This includes a 150 h. p. engine and automatic machines for mixing clays, cutting brick, etc. Capacity will be between 50,000 and 60,000 bricks per day and there is an abundance of excellent clay alongside the plant. O. P. R. O.

98. Hollow building tile. WALTER A. HULL. *N. J. Ceramist*, **1** [2], 87–8(1921).—A brief abstract of an address describing work being done by the U. S. Bureau of Standards. C. W. PARMELEE

99. The "Pontam" system of paving. ANON. *Quarry & Surv. & Contractors' Journal* (London), **27** (1922).—This system was devised by the Société des Hauts Fourneaux et Fonderies, Pont-á-Mousson, France, and was first utilized 10 years ago; though the metal then employed was not so well suited as it is now, the roadway treated is still in perfect contition. The paving consists of (1) a layer of concrete of a depth varying between 0.1 m. and 0.2 m., according to the firmness of the ground on which it is laid, and (2) a layer of cement 1 cm. thick to level the concrete and take, before setting, a reinforcement of cast iron depressed pieces in the form illustrated below. This reinforcement is gently embedded in the cement, the depressions being placed downwards and so arranged as to resist sinking; the number of pieces laid range between 16 and 25 per sq. m., according to the traffic to be supported. Regularity in laying is ensured by means of a line, and uniformity of surface is maintained by templates and flat rulers placed on the materials. A surfacing of cement and small gravel (quartz or hard rock may be substituted) in the proportion of 0.8 kg. to 1 kg. of cement per cu. m., and a depth of 4 cm. covers the reinforcement. The surfacing has to be skilfully carried out in such a way as not to displace the reinforcement; it must also be done before the cement layer has completely set so that the two may be incorporated. Surface setting must take place gradually; under a hot sun the concrete is covered with old sacking, which can be watered now and then, likewise in winter, frost has to be guarded against. This mode of paving has many advantages. In the first place it can be fitted to all degrees of traffic, in the second it is non-slipping and non-tripping, the small part of the reinforcement at the surface running diagonally to the roadway, and it is very economical with regard to maintenance, being by French computation,

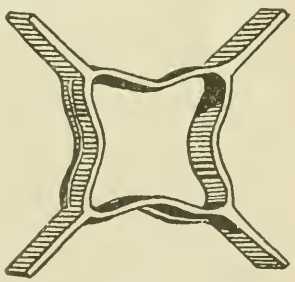

FIG. 1.

from 25 to 35% cheaper to maintain than other paving. Up to the present no roadways with this reinforced concrete paving have yet been opened for pipe laying, etc. In trench making, special care would, of course, have to be taken to conserve the symmetry of the reinforcement, because a number of pieces would necessarily be broken in the excavation, and their replacement requires time and skill. O. P. R. O.

100. The manufacture of tiles in East Africa. ANON. *Bull. Imperial Inst.*, **19**, [3], 297–311(1921).—The provision of roofing material for buildings in the tropics is often a matter of some difficulty. Corrugated iron is largely employed but is costly, and tends to make the building unbearably hot. In several countries in Africa it has been suggested that roofing tiles should be made locally, and search has been made for suitable materials. Specimens of clay and sand, collected in Uganda, and of clay, shale and diatomite from Kenya Colony, have recently been examd. at the Imperial Institute, and the results of the investigation are given in the present article. As diatomite does not seem to have been used hitherto for making roofing tiles, the trials now reported are of special interest. O. P. R. O.

101. Economical use of fuel in the manufacture of brick. GUNTHER. *Arch. Wärmewirtschaft*, **6**, 114–6(1922).—Brick are fired in the Hoffmann continuous kilns to a large extent in Germany. The customary manner in firing these is to throw coal in through holes in the crown from which it is allowed to fall to the bottom through spaces left between the brick underneath the holes. In a new method of firing these kilns, G. sets the brick so the coal does not always fall to the bottom of the kiln but it drops on brick grates placed at different elevations in the kiln. Thus the coal instead of burning at the bottom of the kilns burns in the middle and at $^3/_4$ of its height as well as at the bottom. These positions are clearly shown by diagrams. This method permits more uniform heat distribution in the kilns, better draft, increased production and economy in fuel. It was claimed that by changing from the old method of firing to the new that the time of firing was reduced 12%. The production was increased 15% in one case, 30% in a second and 40% in a third. A saving of 25–40% fuel was also obtained. H. G. SCHURECHT

102. The reddish brown color of sewer pipe. ANON. *Taschenbuch für Keramiker, Keram. Rund.*, **30**, 26–8(1922).—The firing of sewer pipe may be divided into 4 periods. In the 1st period the mechanical and chem. water is driven off and the bituminous matter oxidized. During this process the ware is fired with open fire causing an excess of air to be present in the kiln. In the 2nd period the kiln atm. becomes reducing due to the increase in temp. which necessitates a reduction of the incoming air. This changes the red iron compds. to the blue-gray forms. In the 3rd period the ware starts to shrink and vitrify when the rate of firing is gradually decreased. During this part of the burn the salt is introduced either in one round or three rounds. The salt can also be mixed with the coal and the mixt. fired during this period. The 4th period is the one in which the desirable reddish brown color is developed. In finishing the kiln all fires must extinguish about the same time. As the fires die down the kiln atm. becomes richly oxidizing due to the influx of air. The fire holes are then plastered up to keep the ware at high temps. with this oxidizing atm. as long as possible. This changes the blue-gray glaze to the desirable reddish brown color. If the fire holes are closed before the fire has completely burned, the remaining coal will burn with a strongly reducing smoke, causing the soot to combine with the glaze. This produces the dark glaze but not the desirable reddish brown glaze. This step requires a burner with considerable ability. If the coal is allowed to burn up entirely before the fire holes are closed it may allow too much cold air in, which would cool the kiln down below a point where it will not develop the reddish brown color but will cause the pipe to have a glaze which is too light in color. In order to det. the proper time to plaster up the fire holes a peep hole is placed just above

the fire door about 1″ in diam. By removing a plug one can observe exactly when the last of the coal has burned after which the fire holes should be closed. It may be necessary to handle different kiln slightly differently to produce the same results but when this has once been detd. the same conditions may be reproduced in later burns. It is also important to watch the draft gauge during the first 24 hrs. after the kiln has been finished and duplicate the best of these conditions in later burns. H. G. SCHURECHT

103. Blisters on sewer pipe. S. *Deut. Töp. Zieg. Ztg.*, 53, 205, 206(1922).—One can often notice lump-like blisters on both the inside and outside of salt glazed sewer pipe. If broken open a hollow space is usually found underneath the blister. Similar blisters are often found in brick and are in this case attributed to the bituminous matter in the clay which has not been thoroughly oxidized before the outside of the brick vitrified. Since extremely plastic clays are used for making sewer pipe which are difficult to oxidize it seems probable that this may be the cause of some of the blisters on pipe. It is often claimed that these blisters are due to pyrites in the clay. The effect produced by pyrites is different however since this mineral causes small wart-like projections on sewer pipe. Clays often contain small amounts of H_2SO_4 which may also cause these blisters. Sulphates decompose liberating a gas before the ware is entirely matured which would cause the pipe to swell where these gases cannot escape. Firing with a reducing kiln atm. will decompose these sulphates at a lower temp. and hence reduce this trouble. In tracing the cause of blisters in a sewer-pipe factory it is well to start in the prepn. room. Entrapped air in pipe will often cause blisters before the pipes are fired. Insufficient pugging and storage of the pugged clay are often responsible for these blisters. If the clay is not thoroughly pugged it will contain considerable air which will be liberated as a blister in the subsequent pressing. Air thus entrapped will expand in drying causing the blister to swell up. If the clay is well pugged so it contains a uniform amt. of water throughout, if stored for some time after pugging and is fed into the press at regular intervals, little trouble due to blisters in the molding room will be encountered. H. G. SCHURECHT

104. The discoloration of brick. ANON. *Brick Pottery Trade Jour.*, 30, 183–9 (1922).—Discoloration of brick may be caused by sol. sulphates of Na, K, Ca and Mg. Yellow and green colorations are sometimes due to V salts and are comparatively rare for though the salts are present in min. quantities in many clays there is seldom sufficient to cause trouble. This discoloration is not as easy to prevent as that due to sulphates. Firing in a reducing atmos. will reduce it. A further cause of this trouble is the salts introduced by stacking the brick on ground contg. ashes and occasionally by stacking them on concrete. In each case no harm is done when everything is dry but the trouble results when the ground or concrete is wet. H. G. SCHURECHT

PATENTS

105. Building brick. BERNARD F. WEBER. U. S. 1,425,302, Aug. 8, 1922. A composite wall or the like, comprising courses of hollow stretcher bricks with corner hollow header bricks all substantially the same size, and binder courses of the hollow header bricks, each stretcher and header brick presenting four plane unbroken surfaces, each stretcher brick having a web extending longitudinally therethrough and each header brick having two transverse webs extending from side to side. C. M. S., JR.

106. Paving block. CHARLES L. SULLIVAN and JOHN D. FLETCHER. U. S. 1,422,193, July 11, 1922. A paving block comprising a base and a tread portion, the tread portion being narrower than the base portion and provided with an intervening longitudinally disposed furrow and with central extensions from opposite ends of the block. C. M. S., JR.

107. Brickmaking. GEORGE A. WARNER. U. S. 1,420,796, June 27, 1922. In a molding apparatus for forming bricks or similar articles, the combination of a mold

box provided with a plurality of compartments and having side walls that are corrugated or fluted, and a member having matching corrugations or flutings that can be passed over the mold box to corrugate the plastic bricks. C. M. S., Jr.

108. Tile construction. Eugene Ceriat. U. S. 1,420,020, June 20, 1922. In a tile structure, units having L-shaped cross-section, the longer of the shanks forming the outer and inner surface of the structure, the shorter of the shanks forming the engaging members between the surfaces, the longer shanks having means to engage for forming flush outside surfaces, the shorter shanks having cut-out portions to form horizontal passages in each of the layers of the structure, the shorter shanks being also disposed in spaced relation to one another to form vertical passages for ventilation, reenforcing rods embedded between the several layers in the structure, and other reenforcing rods disposed through the shorter shanks for connecting and reenforcing the structure vertically. C. M. S., Jr.

109. Slag-brick machine. Charles T. Bray. U. S. 1,420,018, June 20, 1922 A slag brick machine including a horizontal rotary distributor provided at one end with an opening to receive slag from a furnace and having at the other end a plurality of circumferentially spaced outlets adapted to be successively brought to the bottom of the distributor for discharging the slag, an endless conveyor arranged to carry successively a plurality of molds beneath the discharging outlets, gearing connected with the conveyor and the rotary distributor, a friction disk connected with the gearing for actuating the same, a drive shaft having a flexible coupling, a friction wheel mounted on the drive shaft and arranged to engage the friction disk and adapted to be carried into and out of engagement with the same by the flexing of the drive shaft, means for adjusting the friction wheel, a rock shaft having an arm provided with a bearing receiving the drive shaft, and means for partially rotating the rock shaft to engage the friction wheel and to carry it out of such engagement and to vary the frictional engagement. C. M. S., Jr.

110. Interlocking brick. Guy M. Bean. U. S. 1,420,810, June 27, 1922. A brick having a tapered projection and a correspondingly shaped socket at one face and arranged end to end and located inwardly of the edges of the face of the brick. C. M. S., Jr.

111. Brick-scoring mechanism. William F. Richey. U. S. 1,418,880, June 6, 1922. A mechanism for scoring the faces of bricks or blocks prior to the baking thereof comprising a fixed rest, standards disposed respectively on opposite sides of the rest and interconnected at their upper ends to provide a frame, rotary combs disposed on opposite sides of the rest and between it and the standards, the combs being provided with shafts, brackets in which the shafts of the combs are rotatably mounted, the brackets being provided with threaded shanks extending through longitudinal slots formed in the standards, clamping nuts carried by the threaded shanks and engaging the standards on opposite faces to provide for vertical adjustment of the brackets, a transverse shaft having geared connections with the shafts of the combs, flexible means for imparting rotary motion to the transverse shaft, and adjustable bearing brackets in which the transverse shaft is journaled. C. M. S., Jr.

112. Method and means for brick hacking. James B. Ladd. U. S. 1,418,658, June 6, 1922. The method of loading and hacking bricks, which consists in the following steps, moving bricks in the direction of their length, bringing the bricks to rest abutted end to end in rows greater in length than a car, assembling the rows in parallel relationship, sufficient in number to form a layer the full width of the car, and transferring to the car at one operation such part of the assembled rows as shall form a complete layer for the car. C. M. S., Jr.

113. Tile for floor structures. Julius H. Toupet. U. S. reissue 115,369, May 30, 1922. In a building structure, a hollow tile having a top wall consisting of an arched

span increased in thickness from its center towards each side, whereby pressure thereon will be converted into lateral thrust and grooves extending through the exterior faces of the side walls into the thickened portions of the arched span. C. M. S., Jr.

114. Apparatus for molding hollow bodies. Percy A. E. Armstrong. U. S. 1,416,927, May 23, 1922. Apparatus for casting hollow bodies, comprising a mechanically strong core center and a plurality of collapsible mold core sections centered directly upon and supported by the member. C. M. S., Jr.

115. Process and machine for making bricks. William H. Haws. U. S. 1,425,010, Aug. 8, 1922. The process of molding bricks from brick forming material, which consists in supplying a mold with an excess of material, compressing portions of the material near the walls of the mold with greater force than the material removed from the walls, while relieving pressure on the last mentioned portion of the material, then finally compressing all the material. C. M. S., Jr.

116. Interlocking tile. Frank Dochnal. U. S. 1,425,181, Aug. 8, 1922. An interlocking tile comprising a perforated body having its inner face provided with three facial ribs, the intermediate rib extending beyond the plane of the other two ribs. C. M. S., Jr.

117. Brick cleaning machine. Samuel M. Funk. U. S. 1,424,719, Aug. 1, 1922. A cleaning machine including conveyors alongside of one another, cleaning surfaces at opposite sides of one of the conveyors, an abutment element beyond the cleaning surfaces for guiding the articles to be cleaned on to the second of the conveyors and turning the articles over upon a cleaned side, and a second set of cleaning surfaces at opposite sides of the second conveyor beyond the abutment element. C. M. S., Jr.

118. Superlocking hollow tile. Otis V. Neese, Flo L. Neese and Earl C. Neese. U. S. 1,424,372, Aug. 1, 1922. A superlocking hollow tile block comprising a pair of equal-sized hollow sections, one section extending beyond one end and the side adjoining that end of the remaining section, the sections having interposed thickened walls for spacing the sections apart, and the walls extending and being reduced beyond the overlapped portions of the two sections, the reduced portions of the walls being integral with the opposite sections at opposite ends of the block. C. M. S., Jr.

119. Brick. John Edward Evans. U. S. 1,422,949, July 18, 1922. A brick comprising a body portion, a flange on the inner edge of a side of the body portion, a recess formed on the inner edge of the opposite side of the body portion adapted to receive the aforementioned flange of a contiguous brick in a structure, a groove formed in the periphery of the body portion on one of the sides, a wedging tongue on the periphery of the opposite side adapted to be received in the aforementioned groove of a contiguous brick in a structure, the flange being provided with an opening to receive a nail or other fastening extending diagonally therethrough in the general direction of the side of the brick remote from the flange. C. M. S., Jr.

Glass

120. Some properties of lime-magnesia glasses and their commercial application. II. S. English and W. E. S. Turner. *J. Soc. Glass Tech.*, **20**, 357–63(1921).—*The annealing temp. and expansion coeff.* of the series of glasses described in Part I, are given. The annealing temp. for the lime-magnesia glasses is considerably lower than for the corresponding glasses contg. only lime or magnesia. The coeff. of expansion decreases continuously from 8.44 to 7.54 $\times 10^{-6}$ as CaO is replaced by MgO. The advantage of the addition of MgO to the batch was now clear. Possible cheap commercial sources of magnesia are discussed. The probable advantage of adding small amounts of alumina to the lime-magnesia batch was suggested. G. S. Fulcher

121. Measurement of small variations of refractive index throughout meltings of optical glass. A. J. Dalladay and F. Twyman. *J. Soc. Glass Tech.*, **20**, 325–30 (1921).—To test the homogeneity of a melt, a number of samples, about $^1/_{10}$″ thick, were polished flat, placed in optical contact, heated until they became a solid block, and then ground and polished perpendicular to the plane of the samples. When such a composite block is placed in the path of one of the beams of a Michelson interferometer, the central black band will be shifted different amts. by the different samples if they are not of the same index of refraction. Differences of one in the sixth decimal place can thus be readily measured. Results of some tests are given. G. S. Fulcher

122. A suggested method for the determination of the absolute viscosity of molten glass. Irvine Masson, L. F. Gilbert and H. Buckley. *J. Soc. Glass Tech.*, **20**, 337–41(1921).—If the rate of fall of a metal ball were detd. by taking a series of X-ray photographs, the viscosity could be computed from Stoke's equation as corrected by Ladenburg. The method was tested with glycerine syrups and results accurate to about 1% were obtained. By making measurements with balls of different d., such as platinum and nickel, the *d. of the glass* could also be detd. The method is obviously not applicable to lead glasses. G. S. Fulcher

123. The relative advantages and disadvantages of limestone, burnt lime, and slaked lime as constituents of common glass batches containing soda-ash and salt-cake. Anon. *J. Soc. Glass Tech.*, **20**, 341–5(1921).—*Discussion* of article by F. W. Hodkin and W. E. S. Turner in same journal, p. 188. G. S. Fulcher

124. Some properties of lime-magnesia glasses and their commercial application. I. Violet Dimbleby, F. W. Hodkin and W. E. S. Turner. *J. Soc. Glass Tech.*, **20**, 352–7(1921).—*The melting and lamp working properties* of a series of 7 soda glasses with mol. compn. 6 SiO_2, 1.2 Na_2O, 0.8(CaO + MgO), in which the MgO content was varied up to 6.5% and the CaO content decreased, correspondingly, from 9.2 to 0%. It was found that as the CaO is replaced by MgO, readier melting, easier working and less devitrification is obtained up to 2.6% MgO, but with 3.6% or more MgO, the glass is less easy to melt and to work than the pure soda-lime glass. G. S. Fulcher

125. The effect of the rays from radium, X-rays and ultra-violet rays on glass. J. R. Clarke. *J. Soc. Glass Tech.*, **5**, 155–65(1921).—Results previously obtained by Doelter and others for various glasses and allied substances are summarized. In order to ascertain the *effect of selenium and cobalt oxide on the coloration of soda-lime glasses*, 3 glasses contg. up to 0.13% of selenium and three with up to 0.004% cobalt oxide were exposed to the various radiations. X-rays, ultra-violet rays and γ-rays produced no effect with the exposures tried but β-rays colored the glasses brown, to a depth equal to the range of the rays. With prolonged exposure the coloration increased to a max. which was darker the greater the amt. of coloring agent present, and then remained constant. The pure soda-lime glass was not affected by the β-rays but was slightly colored on the surface by the α-rays. All the glasses showed *fluorescence*, due chiefly to the α-rays, but the colored glasses alone showed a marked fatigue effect after reaching maximum coloration. All the glasses after exposure to the emanation showed *thermo-luminescence* with disappearance of color after longer or shorter heating at 100°, 160° and 235°. It is believed that the coloring of the glasses is due to the formation of colloidal particles, perhaps by the action of the rays on dissociated ions present in the glass. H. P. Hood

126. On the quantitative study of technical problems in the glass industry. M. W. Travers. *J. Soc. Glass Tech.*, **5**, 124–33(1921).—Presidential address. A plea for well-planned research and quantitative methods of attacking problems relating to the glass house. H. P. Hood

127. The thermal expansion of glasses containing aluminium. S. English and

W. E. S. Turner. *J. Soc. Glass Tech.*, **5**, 183–7(1921).—Soda and soda-lime glasses contg. considerable propns. of aluminium have comparatively low thermal expansions. On the basis of mol. compn. Al_2O_3 reduces the expansion most, MgO less, and CaO least of the 3 oxides, when substituted for soda in tri-silicate glasses. On the basis of wt., however, MgO has much the greatest effect, lime and alumina being of about equal value. Owing to the acidic properties assumed by Al_2O_3 at times it is pointed out that it may not substitute sodium oxide in exactly the same way as calcium or magnesium oxide. H. P. Hood

128. The relative advantages and disadvantages of limestone, burnt lime, and slaked lime as constituents of common glass batches containing soda-ash and salt cake. I. F. W. Hodkin and W. E. S. Turner. *J. Soc. Glass Tech.*, **5**, 188–94 (1921).—Limestone is the cheapest of the three and affords mechanical stirring during glass melting. Limes are unpleasant to handle and change in wt. due to absorption of various amts. of moisture and CO_2. A number of crucible melts were made to det. effect on rate of melting and on the fluidity of the resultant glasses of corresponding amts. of limestone, burnt lime and slaked lime. The source of soda was also changed to det. the effect of using soda-ash, soda cake or mixt. of the two. A batch composed of soda-ash and burnt lime melted in all cases faster than any other combination while at corresponding temps. it was also the most fluid. With soda-ash, slaked lime offers a higher melting rate than limestone, while with soda cake limestone gives the higher rate. Glasses contg. salt cake and burnt lime are generally more viscous and melt the slowest. Between the three batch mixts., soda-ash-limestone, soda-ash-salt cake-limestone, and soda-ash-salt cake-lime there is less marked difference. The relative advantages offered by the three forms of lime may be markedly changed by changing the source of alkali, soda-ash or soda cake. Glasses made from soda cake alone tend to carry a slight scum. Soda cake or mixts. of the two sodas produced no such result. H. P. Hood

129. The effect of the joint presence of sodium and potassium on the solubility of lead glasses. The development of various types of glass. XI. C. J. Peddle. *J. Soc. Glass Tech.*, **5**, 195–201(1921).—It is found that the maximum durability in an alkali-lead silicate glass is obtained when the alkalies K_2O and Na_2O are mixed in the ratio of 7 to 3, and that the ratio holds good for all percentages of alkali below 20 and is furthermore independent of the amt. of SiO_2 or PbO in the glass. The substitution of PbO for SiO_2 improves the durability when the PbO is under 50%. In the alkali-RO-SiO_2 glasses where RO represents CaO, PbO, BaO, SrO, ZnO or MgO, when the total alkali present is less than 20%, the glass contg. both alkalies in equal propns. by wt. will be less sol. than either the glass contg. all its alkali as K_2O or all as Na_2O. Cf. *Ceram. Abs.*, **1**, 20, 81, 165–66(1922). H. P. Hood

130. Durability of optical glasses. Report on an investigation on the determination of the durability of optical glasses. T. Haigh. 51 pp. Pub. by British Scientific Research Association, London. Oct., **1921**.—Systematic study of tests used to determine durability and estimation of alkalinity, by the iodeosin reaction. Values of freshly fractured and weathered surfaces. Investigation of polished surfaces. Changes in the alkalinity of fractured surfaces with variations in the conditions of weathering. Influence of chem. compn. on the alkalinity of the surfaces. Durability as detd. from a visual examn. of the polished surfaces after autoclaving. Alkalinity of aqueous extracts of the glasses after autoclaving. Alkalinity of glass surfaces after autoclaving in steam. The dimming test. Retention of moisture by the glasses in the powdered form. Summary and microphotographs of "weathered surfaces." W. M. Clark

131. American factory successfully makes 40-inch telescope disc. Anon. *Glass Worker*, **41**, No. 45, 9, 29–30(1922).—The optical department of the Spencer Lens Co.

has completed the largest disc ever made in the U. S. This disc is 8 inches thick, weighs 900 lbs., and will be a part of the first all-American telescope. The glass is a borosilicate crown of low coeff. of expansion. Its compn. is SiO_2 70.8, K_2O 14.4, Na_2O 5.4, CaO 2.0, B_2O_3 7.2, As_2O_3 0.2. J. B. Patch (*C. A.*)

132. The effect of absorbed gas on the conductivity of glass. V. Bush and L. H. Connell, Jr. *Franklin Institute*, **194** [2], 231(1922).—Results show that gases in particular water vapor, penetrate throughout the vol. of glass and quartz and radically affect their vol. conductivity. Vol. resistivity of Corning G-702 glass was increased 6 times when heated in a vacuum. On exposure to air, resistivity decreased slowly but did not return to the original value. Pyrex glass and quartz was also tested showing similar results. R. J. Montgomery

133. Making white flint glass in a tank furnace. F. W. Adams. *The Glass Worker*, **41** [50], 11(1922); *Pottery Gazette*.—Colorless glass to replace pale green glass requires purer materials. General discussion of tank, tank block, batch, decolorizers and annealing is given. R. J. Montgomery

134. Note on the composition, or the comparative composition, of glasshouse pots made in the last fifty years. G. V. Evers. *J. Soc. Glass Tech.*, **20**, 330–7(1921).—Some pieces of pot made by E. J. and J. Pearson of Stourbridge in 1868 and 1887 had come to light and had been compared with a pot made in 1921. The silica and alumina in the 1921 pot run 60 and 26% instead of 65 and 23% in the older pots, and though the alkali is somewhat higher, the refractory standard is, if anything, higher, and the porosity somewhat less. The importance of coöperation between the makers and users of pots in keeping accurate records of performance and properties is emphasized. G. S. Fulcher

135. Specifications for lime-flint glass tumblers. Anon. Bur. of Standards, *Circ.* **119**.—Specifications are given for a plain pressed hotel tumbler made of lime-flint glass. The items include the designation, measurements, material, quality, tolerance in size and weight, shock test, boiling test, acceptance, and sampling. They were formulated under the auspices of the Bureau of Standards and have been accepted by the Army, Navy and Marine Corps, Public Health Service, and General Supply Committee of the United States Government. At least 95% of the samples must pass all tests. The tests include 5 fillings with boiling water with sample at room temperature at the start (the shock test); and boiling for 6 hrs. to disclose any sign of corrosion, scumming, chipping or cracking (boiling test). Traces of color or bubbles if not unsightly are allowed but there must be no stones, cords, nor fine cracks. The dimensions, wt., and capacity, are specified with the min. and max. allowable for each. H. F. S.

136. Specifications for glass refractory materials. W. J. Rees. *Jour. Soc. Glass Tech.*, **6**, 181(1922).—This is a critical review of the Provisional Specifications which were proposed about three years ago, by a Comm. of the Soc. of Glass Tech., after a consultation with representative manufacturers of refractory materials for the glass industry nominated by the Employers' National Council for the Clay Industries. Though these specifications have been used but little it will be generally agreed that the proposed specifications for silica bricks and blocks which have been made to comply with the specifications have given excellent results in practice. Sp. gr. of bricks; bonding ingredients and powder density; expansion; and mech. strength are discussed; also storage of refractories. Specifications for tank-blocks are dealt with at length. Specifications for pot clays are even more debatable than in the case of silica bricks and tank-blocks. Much discussion has taken place as to the relative merits of siliceous and aluminous clays for potmaking, but the factors other than chem. compn. of the clay which affect the durability of the pot may obscure the real issue. Two important properties of aluminous clays must receive consideration in connection with their use for

pot-making: their great contraction at high temp. and their low mech. strength at high temp., the latter factor causing bulging and often collapse of the pot. Siliceous clays have a much smaller contraction than aluminous clays, and pots made from them have a greater mech. strength at high temp. The maturing of pot clay and the drying of pots are two subjects on which extended investigation is desirable. Information is also required as to the relative thermal conductivities at glass-founding temp. of the various types of siliceous and aluminous clays. Progress in the production of pot clays is essential to the development of the glass industry. O. P. R. O.

137. Lime specifications for glass manufacture. R. R. Shively. *Chem. Age* (N. Y.), **30**, 296; *Glass Industry*, **3**, 154–6(1922); cf. *C. A.*, **16**, 1139.—These specifications vary but little from those recently published. The quantity of Fe_2O_3 should be as low as possible, the general range being from 0.1% to 0.8% and should not vary more than 0.1% in various shipments. The Al_2O_3 and SiO_2 content is not objectionable but when once established the Al_2O_3 should not vary more than 0.5%, and the SiO_2 not more than 1% from the established compn. Fineness is an important factor governed entirely by local requirements. In large tanks coarse stone is preferred. If the tank is being worked to capacity it is believed that fine stone increases production. Unless otherwise specified all limestone and quicklime should pass a 20-mesh sieve. Lime causes 90% of the troubles in glassmaking arising from the batch materials, but much of the trouble commonly attributed to batch materials comes from other sources. J. B. Patch (*C. A.*)

138. Optical problems in glassmaking. H. P. Gage. *Phys. Rev.*, **15**, 247–8 (1920).—The phys. properties of glass are of the highest importance. The danger of unsuitable design of glass is illustrated by the use of curved instead of flat colored roundels in railway signals, thus obviating the possibility of an obscuring reflection produced by the powerful beams of elec. headlamps. The production of glasses possessing selective absorption and transmission of various wave lengths of light is of increasing importance. Demonstration of ultra-violet transmission and absorption of various glasses can be readily made with the aid of the fluorescence of an anthracene coated screen and the infra-red transmission by the ignition of ordinary typewriter carbon paper. J. B. Patch (*C. A.*)

139. The coloration of glass by ultra-violet light. J. B. Nathanson. *Phys. Rev.*, **17**, 408–9(1921).—A new type of glass was produced which when used for 400 hours as a globe for a Hg arc operating at about 87 watts showed no trace of coloration. An old type of glass similarly used developed a distinct purple color. J. B. P. (*C. A.*)

140. Glass technology. G. W. Morey. *J. Ind. Eng. Chem.*, **14**, 823–4(1922).—Prominent among the recent advances in the glass industry are the improvements in the knowledge and technic of glass annealing, the studies of the relation of the phys. properties of glass to its chem. constitution, and the continued extension of the use of glass feeders and automatic machinery. Also noteworthy are the appearance of two new glass publications and the growth of the glass section of the Am. Ceramic Society. J. B. Patch (*C. A.*)

141. The movement of molten glass in pots. H. W. Hess. *Glass Worker*, **41** [40], 11(1922).—During the melting of a filling of batch and cullet there is a positive motion of the mass after fusion has proceeded to a certain extent, much the same as the water in a boiler flows in a positive direction, due to the point of max. heating and the evolution of gases. Unequal heating of the pot may cause a circulation of glass which has been contaminated by the pot clay and thus spoil the melt. J. B. Patch (*C. A.*)

142. Pyrex glass. Oskar Lecher. *Chem.-Ztg.*, **46**, 469–70(1922).—An analysis is given as follows: SiO_2 80.71, B_2O_3 10.47, Al_2O_3 3.55, CaO 0.70, MgO 0.57, Na_2O 4.14. A similarity is claimed to the German glass 59 III. J. B. Patch (*C. A.*)

143. The decomposition of the glass of ancient windows in the church of Thann. M. Battegay, G. Hugel and Th. Voltz. *Bull. soc. ind. Mulhouse*, **88**, 27–30(1922).—The glass consisted of a white and a red layer, the outer surface of the latter being covered with small, whitish, irregular cavities. The white substance in the cavities was shown to be $CaCO_3$ resulting from the slow decompn. of the glass under the action of light and humidity. The glass contained only 65.5% SiO_2. The alky. of the glass decreased its stability and the oxides (of Fe, Al, Cu, Mn, and Zn) which colored it acted as catalyzers to hasten the decompn. A. P.-C. (*C. A.*)

PATENTS

144. Machine for grinding beveled rim surfaces on spectacle glasses. Otto Henker. Germany. 1,422,055, July 4, 1922. In a machine for grinding beveled rim surfaces on spectacle glasses, a grindstone, a shaft rotatably disposed in a body and adapted to hold a spectacle glass, guiding means allowing to displace during the grinding operation the grindstone and the shaft relatively to one another, these guiding means forming with the shaft an angle which differs from 90°, and a cam coacting with a stop for limiting the relative displacement of the grindstone and the shaft, the angle contained by the stop and the guiding means being variable. Cf. *Ceram. Abs.*, **1**, 189(1922). C. M. S., Jr.

145. Method of producing nonshatterable glass. Otto S. Marckworth. U. S. 1,421,974, July 4, 1922. A method of producing nonshatterable glass comprising immersing assembled glass and celluloid laminae in a solution consisting of fusel oil, camphor and methyl salicylate while the solution is at a temperature between 24 degrees and 35°C, subsequently raising the temperature of the solution which has been applied to the laminae, applying pressure to the laminae, and subjecting the parts to a progressively increasing temperature during the pressure. C. M. S., Jr.

146. Closure for molten glass-outlets. Vergil Mulholland. U. S. 1,421,810, July 4, 1922. An insulating closure for the discharge outlet of a container for molten glass, comprising a holder provided with heat insulating material adapted to close the outlet, means for positioning the closure relative to the outlet, and means for yieldingly holding the closure against the outlet. C. M. S., Jr.

147. Method and apparatus for producing sheet-glass. Joseph E. Crowley and Clifford A. Rowley. U. S. 1,422,036, July 4, 1922. In an apparatus for continuously producing sheet glass, a source of molten glass, a pair of horizontal cylindrical metallic rollers having their cylindrical surfaces tinned, means for adjusting the rollers vertically, toward and from each other, means for internally cooling the rollers, means for rotating the rollers in opposite directions, a receptacle containing molten tin in which the lower portion of each roller revolves, means for flowing molten glass from the source into the trough between the rollers, the glass flowing through the slot formed by the contiguous surfaces of the rollers and emerging in the form of a downwardly moving sheet of glass, a heated chamber in which the rollers are located, having a slot in its lower side, and means for cooling the sheet as it emerges from the chamber. C. M. S., Jr.

148. Method and apparatus for the manufacture of glass. Robert Good. U. S. 1,421,210, June 27, 1922. The method of melting glass-making material which comprises introducing the material into a melting tank wherein the material is fed vertically down through the tank in a receptacle of conical shape, wherein by reason of the lessening diameter of the receptacle the material is subjected to an increasing temperature until fusion is effected and the material runs by gravity into the bath in the tank. C. M. S., Jr.

149. Sheet-glass-drawing apparatus and method for drawing glass. John R. Scohy. U. S. 1,420,868, June 27, 1922. The method of drawing sheet glass which

consists in drawing the glass substantially vertical in sheet form and maintaining the edges of the sheet substantially in parallel relation by feeding the glass to the edges through slotted bodies, turning the glass over a member, shearing the turned portion of the glass at a point near the member, and raising the member and the glass to form a succeeding sheet. C. M. S., Jr.

150. Automatic electric heating device for glass furnaces. Walter G. Clark. U. S. 1,420,181, June 20, 1922. An electrically operated heating device consisting of a multiple of heating units arranged in close proximity to the sheet of glass between the tank and the first supporting roller on a continuous window glass-making apparatus, together with a thermostat for automatically determining the amount of energy required in order to maintain the glass sheet at the proper degree of plasticity for successful operation, and means for removing and replacing the heating elements without interrupting the operation of the glass-making apparatus. C. M. S., Jr.

151. Glass cutter. Henry A. Ryther. U. S. 1,419,310, June 13, 1922. In a turret glass cutter which includes a turret-holder composed of a pair of spaced apart jaws and a clamping screw; a relatively thick wheel-carrying turret having counterbored cavities in one side intersecting the periphery of the turret so that each cavity has a mouth on the periphery, and integral studs located in the cavities, and supporting the usual glass-cutting wheels, the cavities being formed to protect the major portions of the wheels, and to permit other portions to project outward from the periphery of the turret, the thickness of the turret conforming to the space between the jaws, so that each side of the turret contacts with one of the jaws. C. M. S., Jr.

152. Apparatus for gathering glass from a molten mass Alfred C. Pilkington and Joseph Gaskill. England. 1,417,684, May 30, 1922. In apparatus for gathering glass, of the pipette type, an obturator adapted to contain a small quantity of glass, means operative to slide the obturator over the mouth of the pipette to open it, and an inner back edge on the obturator adapted, on so sliding the latter, to shear off from the glass in the mouth of the pipette, the small quantity of glass in the obturator. C. M. S., Jr.

153. Method of and apparatus for drawing glass. Clarence P. Byrnes. U. S. 1,425,746, Aug. 15, 1922. In the drawing of hollow glass articles from a tank or forehearth, the steps consisting in feeding air upwardly through the bath, baffling the air to retain distending pressure for the hollow glass body, while allowing baffled air to pass upwardly from within a floating ring by engaging its sides to continuously lift it. C. M. S., Jr.

154. Plate-glass annealing leer. Edwin E. Milner and William J. Lytle. U. S. 1,426,310, Aug. 15, 1922. A plate glass annealing leer having a plurality of muffle heating chambers arranged zig-zag with respect to each other, a plurality of heating flues in the top wall of each of the chambers, means for producing combustion for each of the flues, means common to all of the combustion-producing means in the side wall of each of the chambers, offtake means for each of the flues, and means for connecting all of the offtakes together. C. M. S., Jr.

155. Rotary glass cutter. Carl F. Doerr. U. S. 1,421,921, July 4, 1922. In a rotary glass cutter, a cutter bar, a sleeve adjustably fastened to the cutter bar, a cutter head provided with cutters arranged in spaced relation and projecting from the peripheral face of the cutter head, the latter being mounted to turn on and to slide on the sleeve to allow of adjusting the cutter head on the sleeve, and means securing the adjusted cutter head in place on the sleeve. C. M. S., Jr.

156. Rotary glass cutter. Carl F. Doerr. U. S. 1,424,625, Aug. 1, 1922. In a cutting implement having a plurality of cutters adapted to be brought selectively into cutting relation, embodying a cutter bar, a carrier sleeve longitudinally adjustable

thereon, a stationary abutment at one extremity thereof, an axially movable abutment thereon, a cutter head mounted for axial and rotary movement on the sleeve between the abutments having circumferentially spaced cutters projecting from the periphery thereof, and interengageable means on the confronting faces of the stationary abutment and the cutter head adapted to lock the elements against relative axial and rotary movement upon clamping engagement of the cutter head between the stationary and movable abutments. C. M. S., Jr.

157. Gauge glass. John H. Hanlon and Wm. J. Hanlon. U. S. 1,424,642, Aug. 1, 1922. In a water gauge for boilers the combination of a body having an opaque rear face and a sight opening closed by a cylindrical glass, the interior face of which is furnished with a plurality of projections disposed in a plurality of concentric circles, the projections being also disposed in such manner that they avoid straight line rows in any direction. C. M. S., Jr.

158. Obtaining glass. Jesse M. Said. U. S. 1,424,184, Aug. 1, 1922. In apparatus for delivering molten glass, the combination of a ladle mounted on a horizontal axis over a pool of glass, means for imparting movement to the ladle on its axis to cause it to enter the glass and obtain a quantity thereof, means for swinging the axis of the ladle to cause the ladle to clear the pool, means for inverting the ladle so as to discharge a quantity of glass therefrom, and means for returning the ladle to its position over the pool. C. M. S., Jr.

159. Manufacture of sheet glass. Henry F. Clark. U. S. 1,424,155, Aug. 1, 1922. The method of drawing glass sheets, consisting in drawing a sheet upwardly in a generally vertical direction, bending it over a bending device and moving it in a generally horizontal direction, and subjecting the lower surface of the sheet after it passes the bending device to the action of a heated jet. C. M. S., Jr.

160. Means for controlling discharge from glass tanks. Edward S. Hutton. U. S. 1,423,220; July 18, 1922. The combination of a glass tank and a discharge spout, with a wall between the lower part of the spout and the glass tank and an opening above the wall for the flow of glass from the tank to the spout, a floating block inside the glass tank with a transversely disposed passageway in the block arranged so that when the block is in one position against the wall, the passageway will extend from the lower part of the block to a point higher than the wall and permit the flow of the glass from the tank to the spout, and when the block is turned over will prevent such flow of glass C. M. S., Jr.

161. Sheet-glass drawing machine. Ora M. Cox and Connie C. Rose. U. S. 1,423,195, July 18, 1922. In a sheet glass drawing machine, a frame, a pair of spaced guides located at the opposite sides of the frame, superposed blocks slidably mounted in the guides, worm wheels rotatably carried by the frame, rotatable vertical shafts arranged in opposite sides of the frame, worms keyed to the shaft and meshing with the wheels, means for connecting the shafts together for synchronous movement, connecting rods operatively connected to the worm wheels and to the sliding blocks, movable arms carried by the sliding blocks, crank arms pivotally carried by the sliding block and connected to the movable clamping arm. C. M. S., Jr.

Enamels

PATENTS

162. Method of producing and applying enamel coatings to metallic surfaces. Herbert M. Smith. U. S. 1,425,612, Aug. 15, 1922. As a part of the process of enameling, applying an enamel mixture to a surface which is to be coated, thereby distributing the material over the surface, subjecting it to a fusion temperature and air blast thereto while the fusion is going on. C. M. S., Jr.

163. Method or process of removing enamel from enameled metal articles. WILLIAM E. PATCH. U. S. 1,416,865, May 23, 1922. The method of de-enameling enameled metal articles which consists in subjecting the article in a closed oven to a temperature above the original baking temperature. C. M. S., JR.

Cement, Lime and Plaster

164. Burning cement in two stages. C. DIDIER. *Brick Pot. Trade Jour.*, **30**, 205–6(1922).—In the first stage the cement is fired at 1000°C at which temp. the $CaCO_3$ is dissociated. It is then slaked with water and the impure portions removed by screening. This screened portion is then fired at a higher temp. which forms the sinter. Because of the increased cost of this process it is necessary to increase the selling price of this product over that made with one burning stage. H. G. SCHURECHT

165. Mineral resources of Guatemala. ANON. *Jour. Royal Soc. Arts* (London), **67**, 633(1919).—Limestone is found in great quantities throughout Guatemala. A siliceous volcanic ash is frequently found with the limestone, which can be roasted with the lime for the production of cement, resulting in a good grade product. Graphite and mica also occur in several places. A good grade of marble has been found in very large quantities. There are several salt springs. Large amts. of sulphur are brought to the market by the Indians, who extract the sulphur from the numerous vol. craters. Niter-bearing ground is found in numerous regions. Prospecting presents unusual difficulties because of the thick vegetation and the heavy volcanic ash, both of which hide the rock. With improved shipping facilities it may prove financially worth while to undertake the exploitation of several of these minerals. O. P. R. O.

166. A "blackboard" of soot and cement. ANON. *S. African Jour. Ind.*, **5**, 306(1922).—A new blackboard was constructed on a stone wall thoroughly cleaned, the joints were well raked out and wetted, and the first coat of cement plaster applied, consisting of 4 sand, 1 cement. A second coat of 3 to 1 and finished with a thin layer ($^1/_8$" thick) of neat cement and mineral black (soot from engine smoke-box) in the proportions of 1 bucket of cement to $^1/_4$ bucket soot, well mixed. The surface kept moist for a few days to prevent too rapid external drying. The result has been satisfactory, the blackboard being superior to the ordinary ones, less chalk being used and consequently less chalk dust being produced. A dead finish is obtained, making the writing on the blackboard easily seen from any angle. The soot does not stain the hands when the blackboard is being used. O. P. R. O.

167. Water tightness of concrete structures. H. C. RITCHIE. *Canadian Engineer*, **43**, 355(1922).—An interesting discussion of the whole question of concrete for water-holding structures read recently before the Institution of Water Engineers (London). A greater consideration of the tensile stresses in the concrete is urged. R. would limit the tensile stresses in the reinforcement steel to from 9,000 to 12,000 lb. per sq. in., depending upon the quality of the concrete, the percentage of reinforcement and the head of water on the structure being designed. He recommends that the direct tensile stress should not be allowed to exceed 10% of the ultimate compressive resistance of the concrete at 30 days. He advocates the deliberate localization of cracks through the placing of expansion joints at suitable places, particularly at planes of stoppage between successive day's work. The max. distance apart of these joints suggested is 25 to 30 ft. The advantage of complete sepn. of the bottom of a circular tank from the wall is also pointed out. By this device the restraining moment set up in the structure at the bottom of the wall is completely overcome, while at the same time there is no difficulty involved in making the structure water-tight. Such construction has been adopted with success in America with some comparatively large tanks. O. P. R. O.

168. Electric cement. ANON. *Times Trade Supplement,* **10,** 493(1922).—The new cement now known as "elec. cement" is manufd. by a process different from that adopted by the Lafarge Co. in the production of their "aluminous cement." The latter is made by a water-jacket process, while the elec. cement is produced by fusion of the raw materials in an elec. furnace. The main reason for the adoption of elec. was the high price of coal. The product has many advantages over ordinary Portland cement. The most noteworthy claims made for it are: (1) although slowsetting it hardens rapidly; its strength after 24 hrs. equals that of Portland cement after 28 days; (2) its ultimate strength being much greater than that of Portland cement, the safe working stresses can be increased to 3 times those now generally adopted; (3) it resists absolutely the action of sea water. These advantages are of sufficient importance to outweigh the higher cost of the material. Elec. cement cannot be used mixed with other varieties of cement or lime and great care must be taken when mixing it to see that all utensils have been thoroughly cleansed, so that no trace of lime or cement other than elec. cement remains in them. O. P. R. O.

169. High alumina cements. ANON. *Engineering* (London), **114,** 180(1922).—Experiments to find some binding material which would withstand the destructive action of sulphates in earths and water, on lime mortars and ordinary cements have resulted in producing high alumina cements, differing from Portland cement by valuable properties. Working on lines suggested by M. Vicat's conclusion that a cement for which the ratio (silica + alumina) : (lime + magnesia) is greater than 1, will resist the action of sea water, M. J. Bied began exptl. work with a view to increasing this ratio by raising the propn. of alumina. There are 4 aluminates of lime: $3CaO, Al_2O_3$; $5CaO\ 3Al_2O_3$; CaO, Al_2O_3; and $3CaO, 5Al_2O_3$. The first two of these are of little practical value owing to their extremely rapid setting in contact with water, but the last are valuable either pure or in the form of mixt. and in connection with these that the work has resulted in material of practical utility. In France the materials employed consist of bauxite, schist, limestone and slag. These ingredients are mixed, the mixt. is then melted in the cupola or elec. furnace, run off, cooled and reduced to powder. Normal analysis of the product shows about the following: silica, 10 to 12; alumina, 40 to 45; iron or oxide of iron, 10 to 20; lime, 35 to 40. The resulting material has properties differing in a marked degree from Portland cement. (1) The material does not decompose under the action of sea water, or in contact with earths or water contg. sulphates. (2) The material is slow setting, this action not commencing from 2 to 4 hrs. after mixing, so that ample time is secured for pouring and handling, and the adjustment of reinforcing bars. (3) The cement hardens so rapidly that at the end of a few hrs. the strength exceeds that of Portland cement after several weeks. Setting is accompanied by a considerable rise of temp., up to 175°C shortly after setting, while the action is said to proceed from the interior outwards. As typical of tests showing the characteristics of alumina cements we may give the following: in tests of pure cement of this class, with the standard test-piece a tensile strength of 33 kg. was obtained at 24 hrs., 59 kg. at 48 hrs., 64 kg. at 72 hrs., 67 kg. at 7 d., and 71 kg. in 28 days. A first-class Portland cement gave comparative figures of 10 kg., 22.5 kg., 33 kg., 50 kg., and 55.5 kg. respectively. A 1 : 3 mortar of high alumina cement gave, for similar periods, 29 kg., 34 kg., 35 kg., 36 kg., and 38 kg., the corresponding Portland cement mortar tests showing only 3 kg., 7.5 kg., 11 kg., 19:5 kg., and 27.5 kg. For concrete the superiority of the alumina cements is equally good, if not better than is shown by the above tests. For compression tests the results are even more interesting. In this case a block of neat alumina cement gave 470 kg. per sq. cm. at 24 hrs., 687 kg. at 48 hrs., 743 kg. at 72 hrs., 815 kg. at 7 days, and 959 kg. at 28 days compared with 70 kg., 141 kg., 264 kg., 456 kg., and 612 kg. for neat Portland cement. In the 1 : 3 mortar alumina cement

gave in compression 352 kg., 387 kg., 400 kg., 431 kg., and 475 kg., while Portland cement showed only 18 kg., 55 kg., 84 kg., 164 kg., and 287 kg. for similar periods. The increased strength of high alumina cements is thus very marked. On the Northern Railway of France these cements have been used for concrete buildings. No trouble has been found in effecting sound joints between new and old work. In the manuf. of concrete pipes, a repetition job, the fol. advantages have been found: (1) a reduction in forms, and increase of output, (2) a weaker mixt. has been possible with reduced thickness and less reinforcing, resulting in reduced finished wt. Pipes have been delivered and laid the day after pouring. For transmission line standards similar savings in time and wt. have been secured, where these standards have to be transported for erection into the heart of mountainous districts. The quick hardening properties make concretes of these cements suitable for pre-cast work, while pre-cast elements of ordinary reinforced concrete have been joined together in position with high alumina cements with success even in the case of tension members. This cement made it possible in a bank to convert rapidly a complete floor of small rooms into a series of halls with large clear floor spaces, and considerable spans. Spans of 18 m. were introduced without difficulty, though it would have been impossible to bring into the building and manoeuver into place girders of that length. Further, Portland cement reinforced concrete would have involved obstruction of the normal work too long a period. In this case the forms were removed in 48 hrs., and the whole job completed without interfering with office work on the 3 floors above. In districts where power is cheap the elec. fusion method of production has advantages. In many cases the overall savings have been well established, while the economy in time is often the detg. factor in the situation.

O. P. R. O.

170. Alumina cement, its development, use and manufacture. H. S. Spackman. *Eng. News-Record*, **88**, 831–4(1922).—S. discusses the properties and use of high alumina cement as manufactured in France. J. C. Witt (*C. A.*)

171. Heat distribution in burning cement clinker. E. H. Whitlock and C. E. Burgoon. *Concrete* (Cement Mill Section), **20**, 87–94(1922).—The authors studied the operation of a cement kiln by taking the temps. at various stations by pyrometers, measuring the draft, and analyzing the kiln gases and samples of the raw mix taken at various points in the kiln. They obtained some interesting data on the heat required for the various reactions taking place. They are of the opinion that it is possible to design a burner that would result in a saving of at least 25% of the coal now required.

J. C. Witt (*C. A.*)

172. Segregation as it applies to tanks as segregating or mixing devices. Charles Catlett. *Concrete* (Cement Mill Section), **20**, 95–100(1922).—C. points out the importance of segregation in many mfg. processes and discusses some of the factors which influence it. He applies the results of his expts. particularly to the manuf. of cement and points out a no. of points at which segregation may be greatly diminished by the application of several elementary principles. J. C. Witt (*C. A.*)

173. Excess air in cement kilns. C. O. Sandstrom. *Concrete* (Cement Mill Section), **20**, 112(1922).—S. discusses the quantity of air necessary for a cement kiln and states that he believes many kilns are operated with too much draft.

J. C. Witt (*C. A.*)

174. Asano Portland Cement Company of Japan. P. C. Van Zandt. *Concrete* (Cement Mill Section), **20**, 63–73(1922).—A description of the raw materials, equipment, mfg. processes, and the cement produced at the 7 plants of the Asano Portland Cement Company. J. C. Witt (*C. A.*)

175. Possibilities of fusion process for cement production. S. L. Meyers. *Concrete* (Cement Mill Section), **20**, 105–7(1922).—M. states that the fusion process has

certain advantages in fuel economy not possessed by the sintering method, and that it does not present insurmountable difficulties. J. C. W. (*C. A.*)

176. Some causes of cracking and disintegration of Portland cement concrete. R. E. Stradling. *Concrete & Constr. Eng.*, **17**, 393–8, 475–80(1922).—S. states that the reasons for cracks and disintegration are very numerous, not well defined and in many cases not understood. In explaining the probable causes sometimes involved, he places them under 4 groups: (1) compn. and phys. state of the cement as received, (2) misuse of the cement, (3) compn. and phys. state of the aggregate employed, (4) conditions to which concrete is exposed. Under (1) he mentions the presence of "dead burnt" lime and magnesia and the possibility of this material slaking after the cement has been hydrated, sulfo-aluminates, and degree of grinding. Group 2 includes (*a*) setting time of cement and amt. of water used, (*b*) proportion of cement, (*c*) methods of molding; (3)—(*a*) water, (*b*) fine aggregate, (*c*) coarse aggregate, (*d*) artificial aggregates; (4)—(*a*) moisture, (*b*) electrolysis, (*c*) rusting of reinforcing steel. He concludes that by far the greater no. of failures are due to faulty workmanship or the condition to which the work is exposed. Only a few can be traced to bad materials.

J. C. Witt (*C. A.*)

177. Constitution and hydration of Portland cement. A. A. Klein. *Zement*, **10**, 636–8(1921); *Chimie et industrie*, **7**, 1150(1922).—A review of Richardson's theory of the constitution of cement and of Vicat's, LeChatelier's, Richardson's and the U. S. Bur. of Standards' theories of hydration. A. P.-C. (*C. A.*)

178. The use of slag cement in construction work. Kropf. *Zement*, **10**, 651–2 (1921); *Chimie et industrie*, **7**, 1150(1922).—Certain brands of slag cements are more sensitive to a strong premature desiccation than Portland cement; but in the presence of brine slag cement hardens more readily than many Portland cements. When properly sprinkled, it is suitable for elevated structures. Owing to the fineness of grinding, large quantities of sand can be added, and the resulting mortars are still relatively strong. Owing to its low CaO content, it is stronger than many Portlands. K. gives the compns. and methods of prepn. used in mining work, more particularly for filling up fissures in rock by injection. A. P.-C. (*C. A.*)

179. Lime-silica-iron oxide. H. Kühl. *Zement*, **10**, 361–4, 274–6(1921).—Alumina is not an essential component of hydraulic cements. The production of cements rich in iron oxide requires the presence of silica in a highly reactive form. The sintering of such cements is similar to that of Port. cement. The hydraulic constituent is tricalcium silicate. The area occupied by cements rich in iron oxide in a triaxial diagram of the system: lime–silica–iron oxide is in nearly the same position as that of the Port. cements in the system: lime–silica–alumina. J. S. C. I. (*C. A.*)

180. Hydraulic setting properties of basic blast-furnace slags. W. Krebs. *Zement*, **11**, 1–3, 15–17, 40–4(1922).—A long series of expts. and a study of the work of previous investigators have shown that all basic blast-furnace slags in a glassy, granulated state can be converted into hydraulic cements by the addition of alkali minerals and gypsum. Such cements harden better than is required by the (German) standard specification, and they are unaffected by 3 months' storage. J. S. C. I. (*C. A.*)

181. Standard and tentative methods of sampling and testing highway materials. U. S. Dept. Agr., *Bull.* **949**, 98 pp.(1921); *Expt. Sta. Record*, **45**, 891.—Standard specifications, as recommended and adopted by the second conference of State highway testing engineers and chemists at Washington, D. C., Feb. 23–27, 1920, are given. These include tests for both bituminous and nonbituminous road materials and tentative tests, as well as forms for recording and reprinting results. H. G. (*C. A.*)

PATENTS

182. Plastic composition. Earle E. Schumacher. U. S. 1,422,483, July 11,

1922. A plastic composition of approximately the following composition: Glycerine 4 parts, plaster of Paris 10 parts, water 1½ parts. C. M. S., Jr.

183. Apparatus for forming concrete pipes. Daniel N. Trullinger and Leo A. Granger. U. S. 1,422,150, July 11, 1922. An apparatus for the purpose set forth comprising a shell, a core disposed longitudinally within the shell, a head supported upon the shell and adapted to travel longitudinally thereof and normally fitting around the front end of the core, and means whereby the shell, the head and the core may each be shifted longitudinally relative to the others. C. M. S., Jr.

184. Cement spreader. Charles J. Bellar. U. S. 1,419,537, June 13, 1922. A spreading machine comprising a receptacle having a distributing compartment at its bottom and wheels at its front within the compartment adapted to support the receptacle in a rolling movement over a floor. C. M. S., Jr.

185. Machine for mixing concrete ingredients or other substances. Frederick W. Kiddie. England. 1,419,737, June 13, 1922. For use in machines for mixing concrete ingredients or other substances, beaters mounted upon a shaft, each beater consisting of a single shank carrying a fork, and having chain form connecting means between the prongs of same, the shanks being inclined out of the radial lines, in order that the forks and chain form connecting means work the concrete endwise of the trough and more perfectly mix the concrete. C. M. S., Jr.

186. Insert for cement or similar floors. Charles H. Fay. U. S. 1,419,548, June 13, 1922. An insert for concrete or similar floors comprising a lower tubular member with an annular flange at the bottom, the flange having anchor elements on its top face, an upper tubular member with an annular flange, a metal sleeve between the flanges and enclosing the inner ends of the members, and means in one of the tubular members for supporting a pipe, the flange serving as a member for securing the support on entering so as to withstand the pouring of cement around the member. C. M. S., Jr.

187. Plastic composition. Kenneth L. Binkley. U. S. 1,418,905, June 6, 1922. A composition of matter comprising pitch and magnesium carbonate, the composition having a melting point of about 200°F. C. M. S., Jr.

188. Apparatus for making concrete bricks. Arthur G. Hatch. 1,425,590, Aug. 15, 1922. Apparatus for making concrete brick or the like, comprising a molding deck, spaced parallel septums of metal extending vertically from the deck, removable pallets fitted between the septums, the bodies of the pallets being formed of wood and being faced with metal having upwardly extending portions adapted to form the end faces of the brick, the pallets being provided with handling clips whereby they may be removed from the molding deck. C. M. S., Jr.

189. Cement tile-making machine. William Gillard. Canada. 1,424,469, Aug. 1, 1922. In a cement tile-making machine, the combination with a mold carrier and molds, means for guiding the mold carrier freely vertically, formers operating within the molds to force the carrier downward as the tile is built up, and counter weights opposing the downward pressure exerted on the mold frame, of normally vertical counterweighted lever bars mounted upon a swingable support, and means operated by the upward travel of the counter weights for drawing the counter weighted lever bars from the vertical to the horizontal position. C. M. S., Jr.

190. Plaster support for walls. Stephen J. Potter. U. S. 1,423,879, July 11, 1922. A paper wall board, comprising a strip of paper of laminated structure, having transverse strengthening ribs spaced apart thereon and attached thereto, each rib being formed transversely into an arch through the greater part of its length but flattened at the ends. C. M. S., Jr.

191. Appliance for throwing mortar for the plastering of walls. Theodor Moser.

Germany. 1,423,536, July 11, 1922. Mortar-throwing apparatus comprising a hopper, a casing into which the hopper discharges, a nozzle leading from the casing, a screw conveyor arranged for rotation in the casing and the flight of which decreases in pitch toward the discharge end of the conveyor, means to discharge compressed air through the conveyor and the nozzle, and driving means for the conveyor.

C. M. S., Jr.

BOOK REVIEW

The Potter's Craft. Chas. F. Binns. 2d. ed. D. Van Nostrand and Co., New York, 1922. The amateur student of ceramics will call blessings upon the head of Professor Binns for his enlarged second edition of "The Potter's Craft."

The Introduction and Chapter on Applied Art are an everlasting foreword for any craftsman or society of Handicraft, whatever the nature of the craft, and exemplifies their reason for existence.

The Chronological Review, of early Chinese to contemporary French and English, runs along racily. It touches upon various phases and outstanding ceramic figures with comment and salient distinctions so pointedly brought out that the lay reader acquires a comfortable sense of being conversant with the chief facts of Ceramic History.

Chapter four leads one to take his spade and discover local clays and gives practical directions for preparing, sieving, shaping and firing. Descriptions of specific clays and their characteristics are discussed and the uses for which they are suitable are defined. The subsequent painstaking details of mold-making, casting, throwing, etc. make one marvel that one who has the greatest scope as a technical educator should have the patience to work out, step by step, all the minutiae, so that the veriest amateur may know the joy of producing. What, but the greatest love for his craft and the greatest sympathy for the most feeble attempts in it, could animate such long suffering and patience!

Surely the amateur in no other craft is so shut out because of the wall of technical terms used by the trained ceramist. He has no language in which even to present his difficulties. In this work scientific expression is so qualified that the layman can, at least, follow the trend of professional method.

This is true especially of the chapters on glazes. The scientific compounding of a glaze batch is so explained that the serious student is inspired to embrace real knowledge in his efforts.

For school work, the book will prove a boon inestimable, as it gives the teacher of many crafts, a working idea of cause and effect, and furnishes formulae together with explanations of their type and application. So alluring is the chapter upon porcelain, that, having been led back to the source, the Chinese, you are keen to try for the impossible and to pursue "Liquid Dawn" or "The Red of the Bean-blossom."

Those who have sat at the feet of Prof. Binns and profited from his vivid presentations, will qualify his words "The personal note, tone and picture may be lost in reading from the printed page" with the reservation to the effect that we do regain an impression of his crisp recital and clean cut utterance which will keep his admonitions and appreciative encouragement always vivid in our minds. Mary Chase Stratton

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ABBREVIATIONS USED IN INDEX

abs.	absolute
a. c.	alternating current
alk.	alkaline
amt.	amount
anal.	analysis
app.	apparatus
approx.	approximate, approximately
at. wt.	atomic weight
av.	average
b. p.	boiling point
B. t. u.	British thermal units
bldg.	building
Brit.	British
cal.	calory(ies)
calc.	calculate
calcd.	calculated
calcg.	calculating
calcn.	calculation
Can.	Canada
cc.	cubic centimeters
ceram.	ceramics
charac.	characteristics
chem.	chemical (not chemistry)
cm.	centimeter(s)
circ.	circular
Co.	Company
Comm.	Committee
coeff.	coefficient
compd.	compound
compn.	composition
concd.	concentrated
concn.	concentration
condy.	conductivity
const.	constant
contd.	contained
contg.	containing
c. p.	chemically pure
cryst.	crystalline (not crystallize)
crystd.	crystallized
cu. m.	cubic meter(s)
d.	density
d. c.	direct current
decompn.	decomposition
det.	determine
detd.	determined
detg.	determining
detn.	determination
dil.	dilute
econ.	economical
ed.	educational
elec.	electric, electrical
e. m. f.	electromotive force
equil.	equilibrium
equiv.	equivalent
est.	estimate
estd.	estimated
estg.	estimating
estn.	estimation
evap.	evaporate
evapd.	evaporated
evapg.	evaporating
evapn.	evaporation
examd.	examined
examg.	examining
examn.	examination
expt.	experiment
exptl.	experimental
ext.	extract
extd.	extracted
extg.	extracting
extn.	extraction
f. p.	freezing point
ft.	foot, feet
fund.	fundamental
fur.	furnace
gen.	general
g.	gram(s)
htg.	heating
h. p.	horsepower
hr.	hour
in.	inch(es)
indus.	industrial
inorg.	inorganic
insol.	insoluble
invest.	investigation
kg.	kilogram(s)
kw.	kilowatt(s)
l.	liter(s)
lab.	laboratory
lb.	pound(s)
lit.	literature

mach.	machinery, machine
mat.	material
m.	meter(s)
manuf.	manufacture
max.	maximum
mfg.	manufacturing
meas.	measure, measurement
mech.	mechanical
mg.	milligram
min.	minute(s)
mixt.	mixture
mol.	molecule, molecular
mol. wt.	molecular weight
m. p.	melting point
N	normal
org.	organic
operg.	operating
opern.	operation
oper.	operate
p. d.	potential difference
phys.	physical
physiol.	physiological
Port.	Portland
powd.	powdered
prac.	practical
ppt.	precipitate
pptd.	precipitated
pptg.	precipitating
pptn.	precipitation
press.	pressure
prep.	prepare
prepd.	prepared
prepg.	preparing
prepn.	preparation
prob.	problem
qual.	qualitative
quant.	quantitative
ref.	reference
refrac.	refractory
rept.	report
resist.	resistance
resis.	resisting
resp.	respectively
r. p. m.	revolutions per minute
sat.	saturate
satd.	saturated
satg.	saturating
satn.	saturation
sec.	second(s)
scien.	scientifically, scientific
sep.	separate
sepd.	separated
sepg.	separating
sepn.	separation
sol.	soluble
soln.	solution
soly.	solubility
sp.	specific
sp. gr.	specific gravity
sq. cm.	square centimeter(s)
specif.	specifications
stand.	standard
subs.	substance
temp.	temperature
tent.	tentative
v.	volt(s)
vol.	volume (not volatile)
wt.	weight

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